ENGINEERING WORKS.

MESSRS. MARSHALL, SONS & CO.

LIMITED,

CALCUTTA.

Reprinted from THE INDIAN & EASTERN ENGINEER, *June 27th, 1896.*

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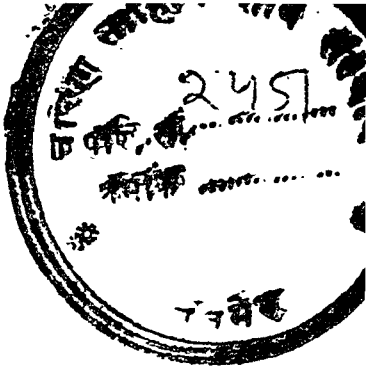

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IT is just a little over a decade ago that the Members of the Institute of Mechanical Engineers, during the course of their annual meeting, were privileged to visit the important works of Messrs. Marshall, Sons and Company, Limited, at Gainsborough, and in looking over our file of exchanges of that period, we find it recorded that the visit was the most interesting and best attended of all the excursions of that meeting. This is only what could have been expected, and therefore we are not surprised to find our London contemporary, *Engineering*, in writing of this visit, saying :—"Probably no better instance could be found of the power of good honest hard work, coupled with mechanical skill and organisation, than the acres of shops, sheds, and buildings, known as the Britannia Iron Works, Gainsborough." Ten years is a good long period to look back upon in these days of high pressure, and it is only to be expected that an enterprising and thriving establishment, such as Marshall, Sons and Company, Limited, undoubtedly is, have far outstripped the description given of their works in the

issue of *Engineering* of the 7th August 1885, from which we have quoted the above paragraph; and we have no doubt that if the same members of the Institute of Mechanical Engineers who formed the visiting body on the occasion referred to, were to-day to re-visit the works, they would probably still hold to the opinion that to the improvements, extensions and additions of a large and enterprising firm of manufacturing engineers, who know their business, there is practically no finality.

Nor can this be wondered at; for the past ten years have seen an advancement in the march of industrial science which requires a watchful and never-failing energy on the part of those whose lot it is to provide the machinery, motive-power, or appliances which ever-recurring improvements in arts and manufactures demand.

We, who live and labour in India, are made aware of the fact that steam and machinery are fast taking the place of manual labour in every branch of industry, and in none more so than in those of tea and indigo manufacture. Where but a few years ago, it was one of the troubles of the manager of a tea estate to find suitable coolies for the process of rolling his tea; a process requiring not only physical capacity but a certain intelligent interest in the operation, which unfortunately was not possessed by every coolie in a tea garden; we now find beautifully designed machines, monuments of mechanical skill and inventive genius, driven by steam engines of splendid workmanship, doing the work in that steady and sure manner which can only be effected by well-designed and perfectly built machines, while the tea-garden coolie looks complacently on and, perhaps, passes a mental vote of thanks to those who have relieved him of the weary and troublesome tasks of days of yore.

What is good for the tea industry, is good also for every other, and in none can it be said that hand-labour is holding its own, or is preferred.

It is then to those who make it possible to bring about this great development, that the people of India should render thanks for this their material advancement. In this direction it can safely be said that Messrs. Marshall, Sons & Co., have played, in these latter years, no small or unimportant a part. We have not far to go to satisfy

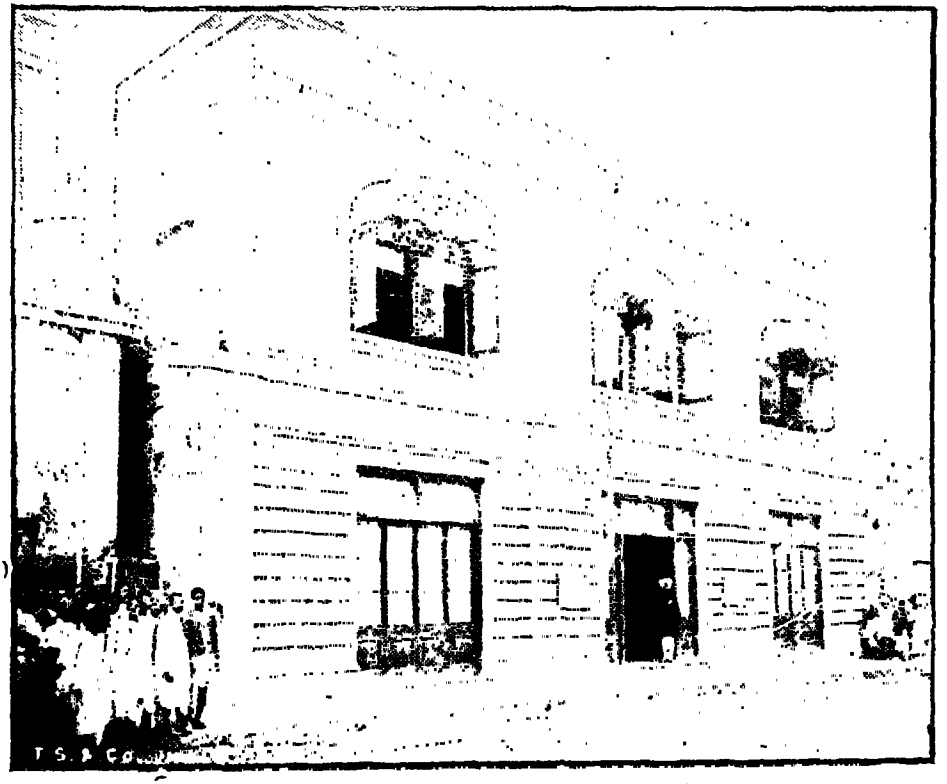


Plate I.—Main Entrance in Clive Street.

ourselves on this head. It is but a stone's throw from the offices of this journal that a handsome and substantial building is to be seen which has been called into existence but a brief twelve-months ago. The name-plates against the wide and stately entrance tell us that these are the offices of Messrs. Marshall, Sons & Co., Ld., and a stalwart *commissionaire* whose military bearing and intelligent look mark him at once as a pensioned Punjabee soldier, confirms this. Now, what we

have to say is that a firm, who but six years ago opened their business in Calcutta, in quite a small and modest way, and practically as an experiment, should, even before the expiry of this short space of time, have found themselves justified in launching into the expenditure which such palatial offices and premises must have absorbed, cannot but have found their experiment a most successful one. Moreover, the success which is reflected in the new offices and buildings of Messrs. Marshall & Sons (as the firm is commonly known) in Calcutta, is most assuredly due to the thoroughly honest and business-like nature of the firm's transactions, which has made their name and fame so universal. It is impossible to gainsay the fact that Messrs. Marshall, Sons & Co.'s name on an engine or any other piece of machinery is, throughout the length and breadth of India, a guarantee of materials and workmanship, accepted by every one who has any dealing or connection with machinery.

A brief history of the parent establishment will not be out of place as a prelude. In the year 1848 an old established engineering and millwright business was purchased by the late Mr. William Marshall, the father of the present managing directors. The works, at that time, chiefly supplied the requirements of the oil and flour mills in the neighbourhood, but later on the manufacture of agricultural machinery and portable and fixed steam engines was taken up. It quickly became apparent that an extension was necessary and a plot of ground 1½ acres in extent was purchased, and upon this plot a portion of the present works was built in 1855-56. The year 1859 saw the firm competing in the various agricultural shows, and in 1860 exhibits of portable engines, thrashing machines, saw-mills and wood-working machinery were for the first time sent by the firm to the meeting of the Royal Agricultural Society. By this time the sons, Mr. James Marshall and Mr. Henry D. Marshall, though still young men, had taken active parts in the

management of the business, and in 1857 Mr. James Marshall joined his father in partnership, the firm being now styled William Marshall & Son. Four years later Mr. Henry D. Marshall also joined the firm, the title being then changed to Messrs. William Marshall & Sons. In 1861 Mr. Marshall senior died, and the sons continued

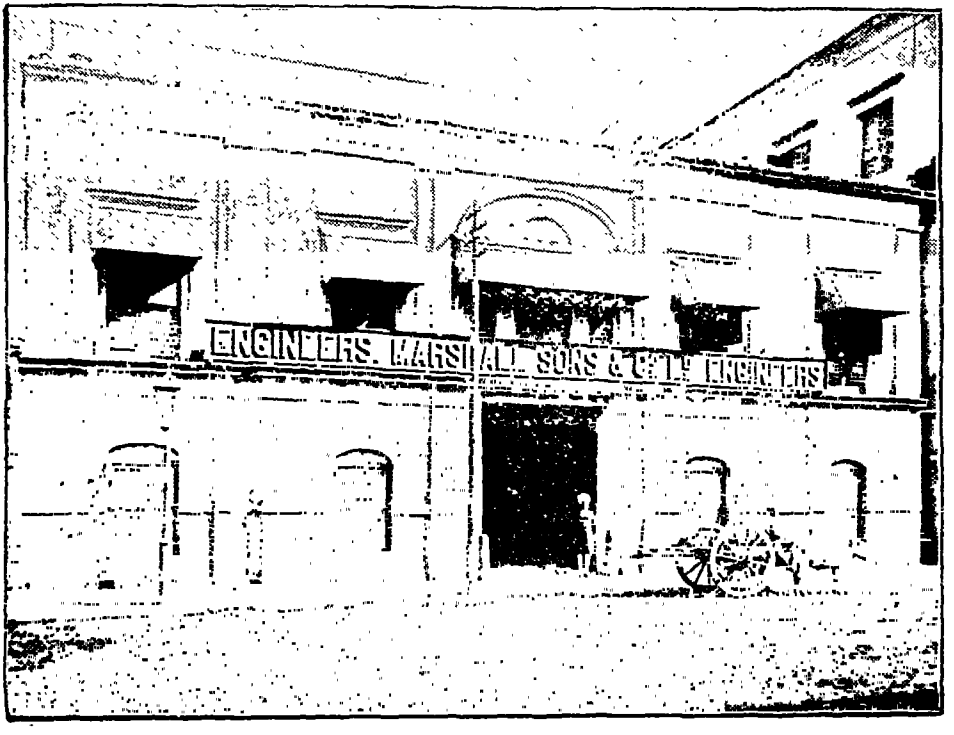


Plate II.—Entrance from Strand Road to Godowns.

the business, directing special attention to the development of the engineering branch and the construction of agricultural machinery. Towards the end of the year 1862, the firm was converted into a private joint-stock company with the old proprietors, Messrs. James and Henry Marshall, as Managing Directors. It is needless to add that under their able control it has prospered and developed in a manner "which has few parallels amongst the engineering establishments of Great Britain." Not only has prosperity fallen on the firm of Messrs. Marshall,

Sons & Company, Limited, but their success has reflected itself in the town of Gainsborough, which, when the business was founded, was a small town "suffering greatly from the loss of its shipping trade in consequence of the introduction of railways," and has now, thanks to the development of the Britannia Iron Works, vastly increased in prosperity and contains a population which has more than doubled itself within the past twenty years. The total area occupied by the Britannia Iron Works in 1885 was over 16 acres; it is now over 26 acres. They are situated on the west side of the Manchester, Sheffield and Lincolnshire Railway Company's main line, the road to the station dividing the works into two parts, known as the north and south sides respectively; a tunnel under the station-road connecting the two divisions. The delivery of raw material into the works is greatly facilitated by the railway station being situated on ground some 28 feet higher than the works, while finished articles are put directly on the trucks in the packing department which is in direct communication with the railway company's sidings.

The premises now occupied by the Indian Branch of Messrs. Marshall, Sons & Co. in Calcutta, Clive Street, were formerly in the occupation of Messrs. Jessop & Co., and comprise an entire block extending across the width between Clive Street and the Strand Road; the frontage in Clive Street is 70 feet, and here also is the principal entrance to the offices. By this arrangement the firm has the advantage of an entrance opening out conveniently close to the jetties and free from any ordinary obstruction to the passages of large packages of machinery, boilers, &c., while the contiguity to the jetties greatly facilitates the import and export part of the firm's operations. To our readers, both here and abroad, it will be matter full of interest to learn how an engineering firm in this country can, when so minded, make its habitation a place worthy of more than a passing notice, and bring it on a level with the best that can be found at Home and abroad. We

have, therefore, obtained the permission of the courteous General Manager of the Calcutta Branch, Mr. John Harper, to reproduce in our pages a few photographs of parts of the premises, and to his kindness we are indebted for the visit which enables us to give the following description, though, unfortunately, we are compelled by exigencies of space to make it but too brief.

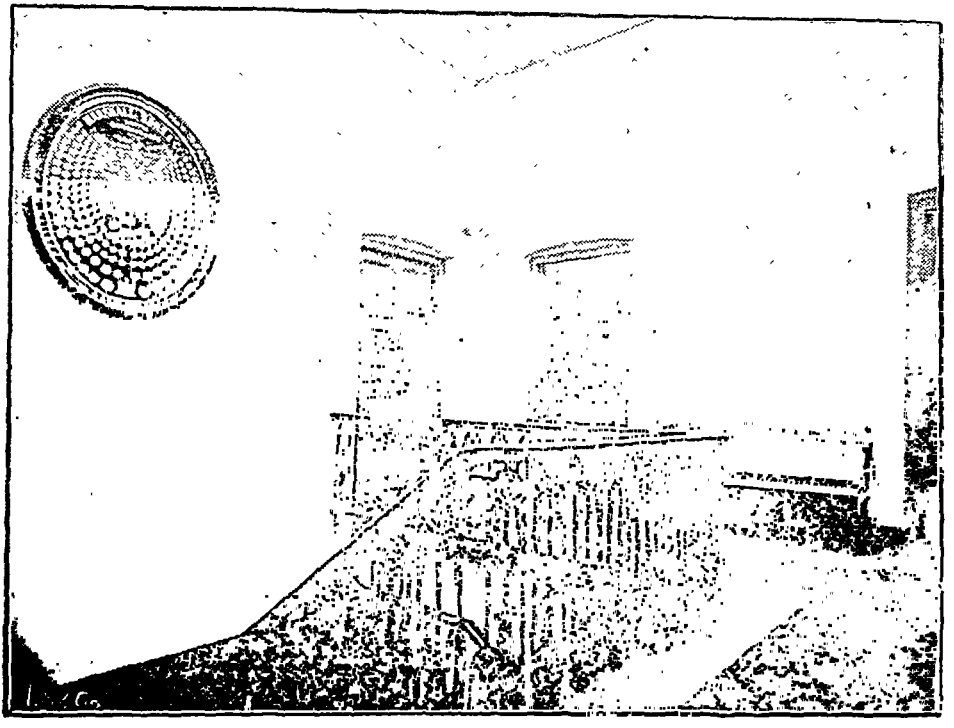


Plate III.—Landing, with Trophy of Medals.

When towards the close of 1894 it was decided to take up the block in Clive Street, it was at once seen that extensive, in fact wholesale, alterations would be necessary to convert the block into premises suited to the growing requirements of the Company. Mr. Henry D. Marshall, one of the managing directors of the Company, was, opportunely, in India at the time, and it was decided to make the new premises worthy of the good-will and patronage which had so unsparingly been extended to the

Company during its short existence in India. The aid of the well-known local firm of builders, Messrs. Mackintosh, Burn and Co., was called in, and the buildings we are now about to take our readers through grew rapidly out of the chaos of bricks, mortar and other *debris* which the dismantling of the old buildings standing on the grounds had created.

Our Plate I is a view of the Clive Street frontage and principal entrance to the offices, while Plate II is that of the Strand Road or godown entrance. The style adopted is massive and well-adapted to the preconceived idea of what the edifice for such a firm should be like. Entering by the main doorway we find ourselves in a handsome lobby, the tesselated floor, broad and handsome staircase and bright carpeting of which contrasts in a very conspicuous manner with the majority of entrances into Indian offices. Ascending the staircase for a couple of flights we come to the landing, when the first object presented to our view is an artistically arranged Trophy, formed of medals won by the Company in the many and various Exhibitions in which its machinery and manufactures have figured; and it is at once made manifest that the repute of the firm is not only substantial but also world-wide. Plate III, page 9, shows the trophy of medals, a list of which, we regret, want of space prevents us from giving. Here also we find photographs of engines and machinery *specialites*, neatly framed, adorning the walls.

Entering by a door opening on to the landing we find ourselves in the General Manager's office, and are at once decidedly of opinion that the designer of the premises knew well what he was about and what conduced to comfort in business, so essential but so often overlooked in this country. It is a large, lofty apartment, well-lighted and ventilated, with handsome and substantial furniture and fittings which we are informed have been supplied—as in fact all the furniture and fittings of the entire suite of offices have been—by the well-known firm of Messrs.

C. Lazarus and Co., of Calcutta. We are further gratified at seeing a copy of our "Railway Map of India" hanging conspicuously on one of the walls and conveniently near to the Manager's table. Our view of this room, Plate IV, gives a far better idea of what it is than any thing we can write, and we therefore pass on to the next, which is the private room of the General Manager; being such

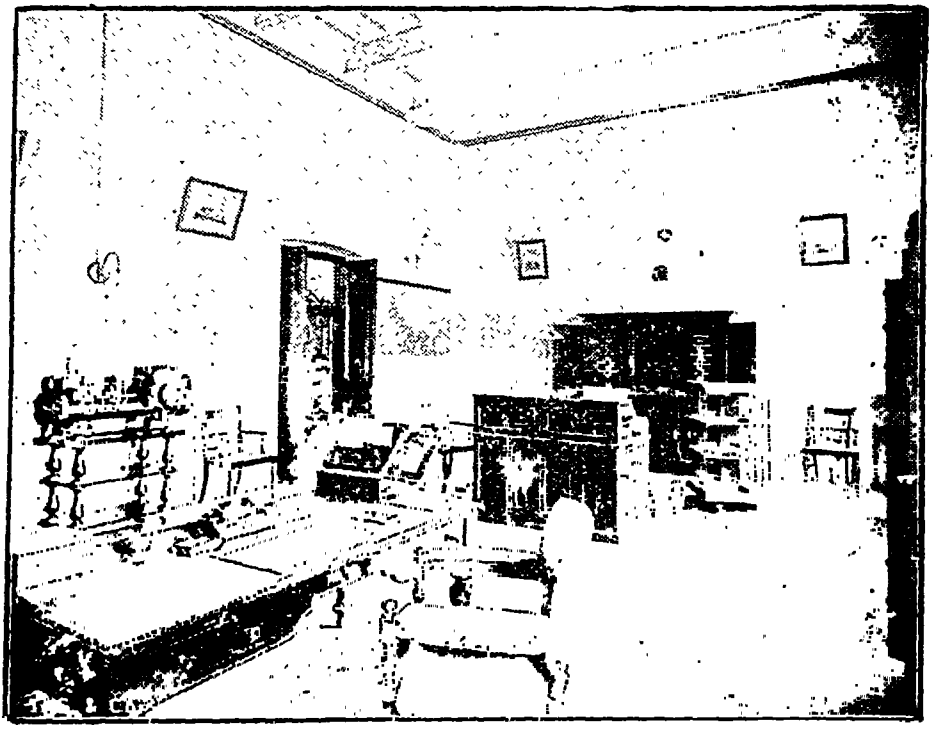


Plate IV.—General Manager's Office.

we refrain from saying more than that it vies with the one just left, in comfort and utility. We would here mention that the whole of the premises is lighted by electric light, the installation being an exceedingly complete one, and the electroliers and lamp-holders well in keeping with the artistic features of the rooms. Electricity is also employed to draw attention when necessary, electric bells carrying the summons of the General Manager to the various offices as required, and presenting

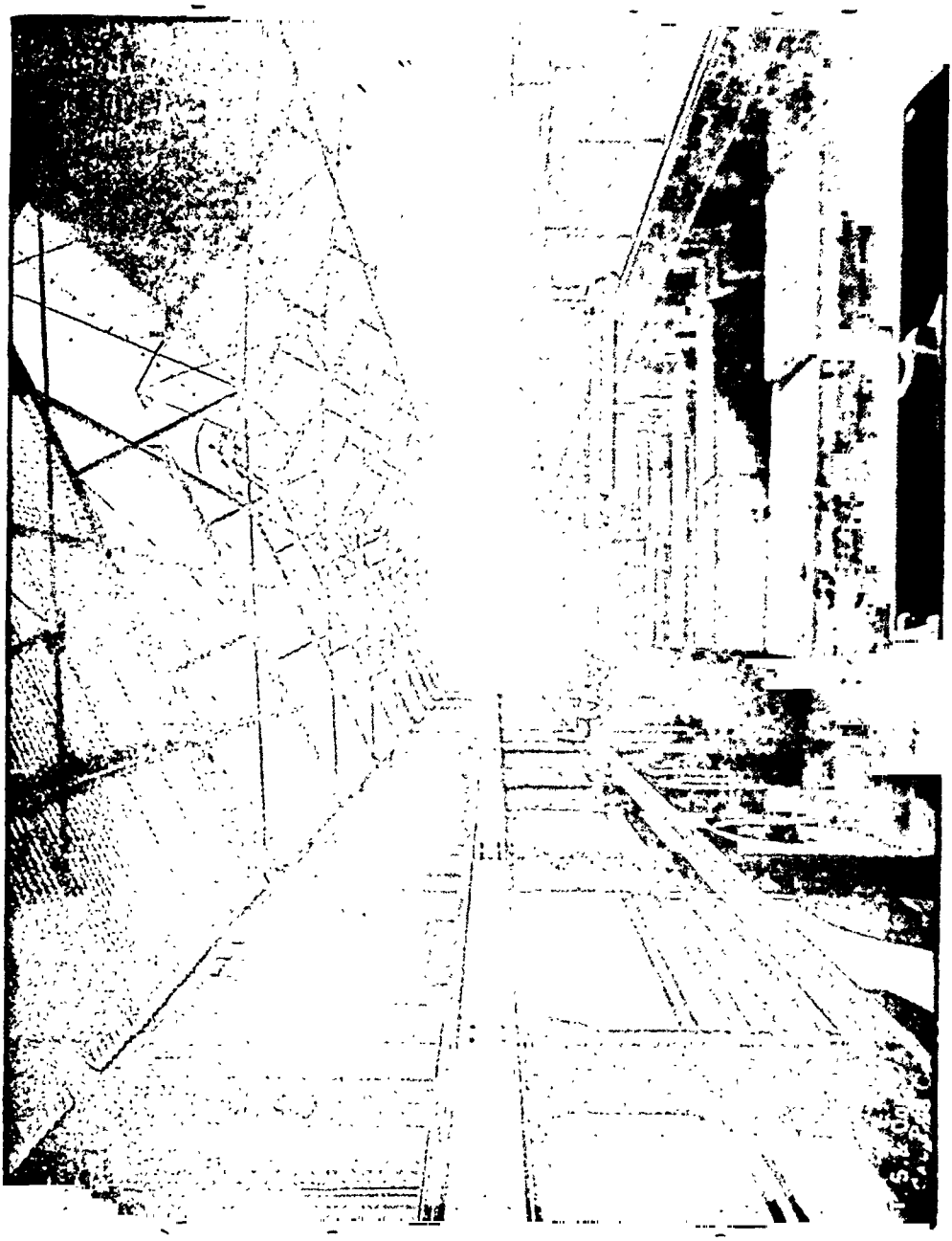
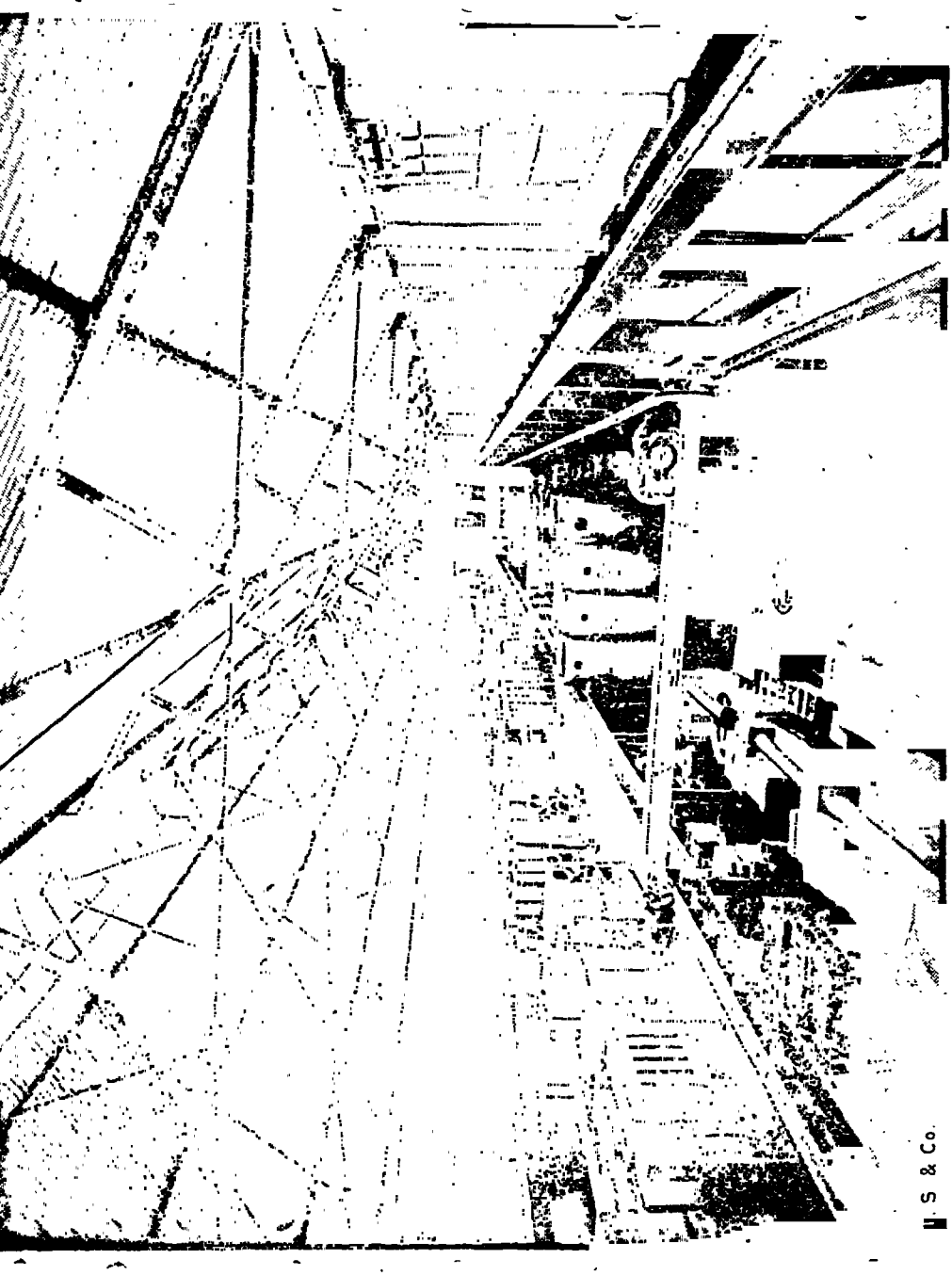


Plate V—Machinery and Boiler Stores, looking West



M. S. & Co.

Plate VI.—Machinery and Boiler Stores, looking East.

another very desirable feature to the general orderliness which prevails in every direction.

Passing through the clerks' offices, we enter into the Assistant Manager's room. One cannot fail to notice the same blending of utility with comfort which is conspicuous throughout the range of apartments and which constitutes one of the chief features of the arrangements. Glancing into the apartment devoted to the typewriters, without whom and the useful machines they manipulate, it would, in these busy times, be almost impracticable to get through the extensive correspondence of a firm doing so large and varied a business, especially where an avoidance of errors due to caligraphy is so very important; we pass on to the well-equipped tiffin-room, and are made aware of the fact that the head of the branch thoroughly understands that to obtain a good and full day's work from his assistants the requirements of their inner-man must also meet with some attention.

Continuing our tour we now descend by a flight of stairs down to the lower or ground floor and passing through a wide doorway find ourselves looking into a vast stores with a vista of huge cases of machinery in the foreground and a background of steam boilers, loco-type and vertical, which immediately impresses us with a full conviction that the statement of the immense business of the Company in this department of engineering manufactures is anything but exaggerated. Plates V and VI depict the scene as viewed from either end of this vast store-house, and should go far towards giving our readers an idea of how largely steam power is utilised in this country in the industries. Looking at the magnitude and evident weightiness of the cases and the sizes of the various boilers one wonders how these ponderous weights are handled or how they are ever to be moved out when wanted, but we have merely to cast our eyes upwards to ascertain that the arrangements made for the manipulation of these goods are quite in keeping with the rest of

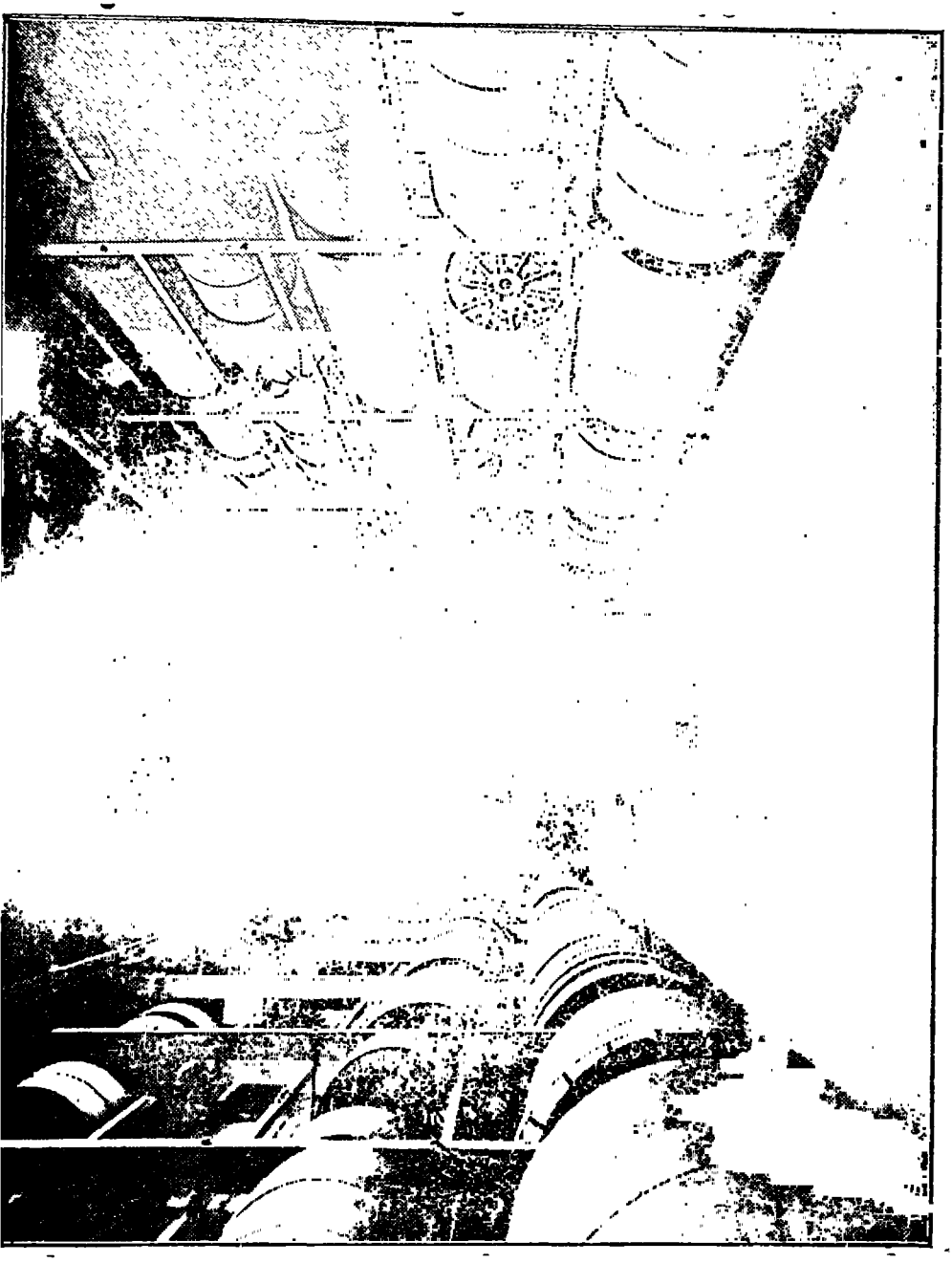


Plate VII.—Pulley and Drum Stores.

the Company's matters and in accord with the maxim of business men throughout the world that "time is money." Supported on the iron columns which carry the roof on each side are the tracks for two powerful overhead travelling cranes, the one moving over the other, on and along a more elevated track. These cranes traverse the length and breadth of the building and command every inch of the floor area. The lower one, seen in our views, is a powerful and easily manipulated 3-ton crane, while the one which runs on the upper track is a still more powerful and withal easily worked crane of no less than 10 tons lifting capacity. The machinery and boiler stores is 450 feet in length with a breadth of 70 feet. Along both sides are laid down rails for lorries, and it does not need much more description to understand that, with the facilities mentioned above, it does not require many minutes after a boiler or case of machinery has been marked down for removal, to find it lifted bodily up off the floor where it rested, raised high above the rest of its fellows, moved rapidly to the nearest side and deposited on the lorry placed for its reception; the operation in fact takes scarcely more time than it takes us to describe it here. Going along one of the side passages we come upon the boilers in stock and are somewhat startled at the appearance of the first lot we come to, which appear to be loco-type boilers possessed with a strong predilection for standing on their heads instead of in what is ordinarily accepted as their natural position. Our view, Plate VI, shows how these boilers are stacked, and at first glance it strikes one as singular that loco-type boilers should be warehoused in the peculiar manner followed here, but the wisdom of the arrangement soon makes itself apparent when we contemplate the large number which are accommodated in this room. Here, in passing, we would refer to the material used in the floor. It does not require much technical knowledge to understand that floors which have to stand such hard wear, as falls to the lot of those

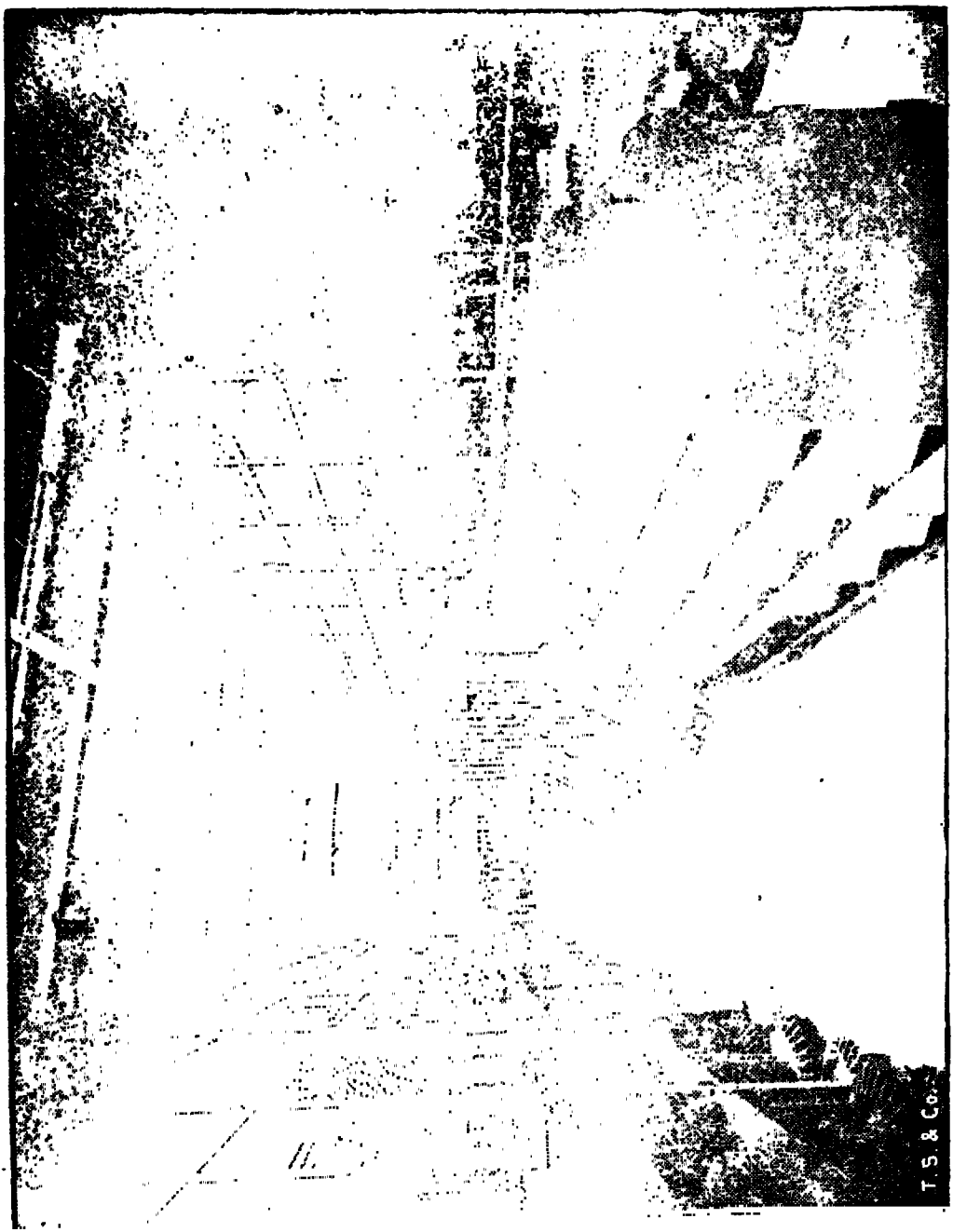


Plate VIII.—Spare Parts and Renewal Stores.

of Marshall & Sons, need to be made of a practically imperishable material, and Marshall & Sons were fortunate in having such close to hand in "Indian Patent Stone." This material has been laid over the entire ground floor of the premises and is now accepted as the only suitable material for such purposes. The boiler stores is roofed in with corrugated iron sheets carried on steel trusses; supplied by the firm of A. and J. Main and Co., Ld. The trusses are supported on cast-iron columns ranged along the sides, these columns also carrying, on suitable brackets, the upper and lower track girders of the 10- and 3-ton travelling overhead cranes before mentioned. The whole of the great width of this room is covered by a single span, which arrangement greatly conduces to economy of floor space in stacking and facility of manipulation.

From the main store-room we are taken into ranges of well-lit and ventilated godowns or stores, the first of these being the pulley room (Plate VII) where are stored pulleys and drums of all sizes from the 6-foot drum required to drive a large ventilating fan to the humble but very useful 6-inch pulley. We next come into godowns (Plate VIII), a visit to which would, we think, be especially attractive to a visiting planter; it would afford not a little relief to know for certain that the mere writing of a letter, giving a number or size, would be all that is requisite to obtain for him a correct duplicate of a damaged or worn-out portion of an engine or machine supplied by this firm. Shelves and racks arranged on a most perfect and yet simple system of keeping stock are here on all sides and along the centres of the room. Every single article is labelled in the fullest manner; everything that can possibly be required in the way of fittings are stocked here. Engine parts have their own particular shelves and racks, tea-rollers have their own, while other shelves and racks provide abiding places for the various details of pump fittings and parts till the exigencies of the user

brings them forth. It is not our place or desire to write up the systems or methods of any one particular firm or enter into comparisons which would be invidious, but we cannot refrain from remarking that Messrs. Marshall, Sons & Co. have, in their arrangements for keeping stock, facilitating its selection and quick compliance with a customer's orders, spared no trouble or expense, and

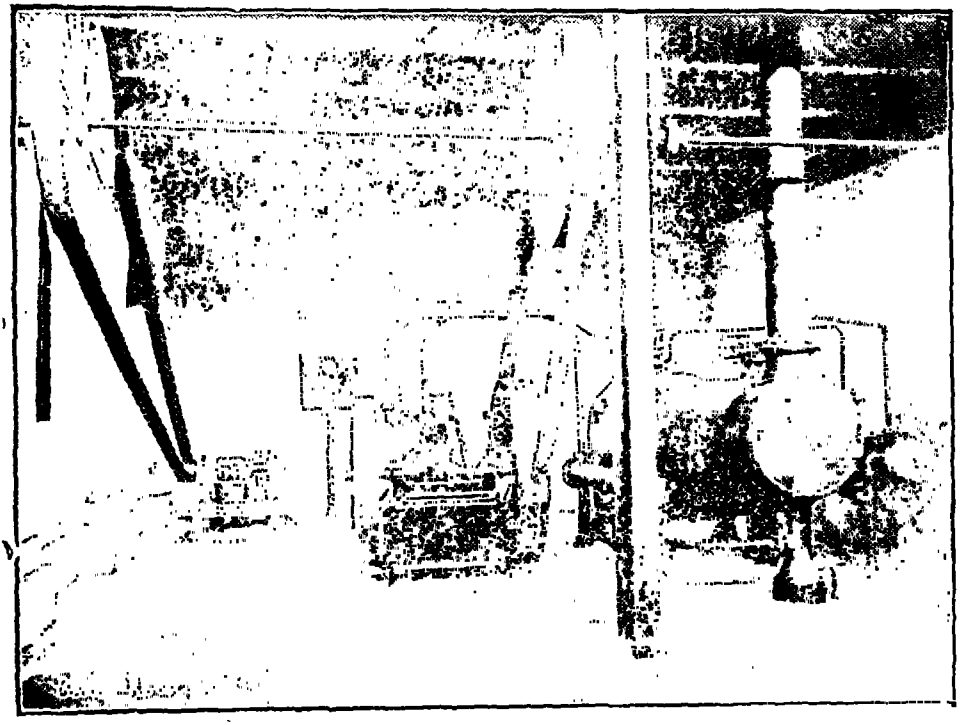


Plate IX.—Dynamo Room.

above all, have imported into their well-stocked warehouses English methods of orderliness and business habits which cannot fail to favourably impress their constituents who favour them with a call.

Leaving the stores we are taken to the dynamo room and find ourselves in touch with as compact and neat an installation as one could desire. This is shown in Plate IX. A 10-H.P. horizontal engine furnished with steam from a loco-type boiler drives a dynamo which supplies

current to about one hundred lights of 50 and 16 candle-power. The boiler is provided with a water-heater, and a Worthington pump gives it its water-supply. A little workshop is next visited. The firm, we understand, will, later on, lay down a complete repairing plant to meet the demands of their constituents ; the workshop is at present only intended for their own special needs.

It is not necessary to enlarge upon the other departments as the packing, &c. ; suffice it to say that they are all models of what such ought to be.

It will, however, interest our readers, especially those who are users of steam, to know something of the firm's modern specialities in engines and machinery, and we therefore give views of two, which we consider as of first importance, regretting that we cannot, through want of space, do more in this number in this respect. The first of these is a view of the firm's latest design in fixed engines. This engine (Plate X) is fitted with the Pröell patent two-valve releasing gear. Economy in fuel consumption has, in these days, led to the use of high pressure steam, and pressures ranging up to 200lbs. are now of ordinary occurrence. Under these conditions very considerable friction has to be overcome when steam distribution is carried out by the ordinary slide valves, there being a consequent waste of power. Messrs. Marshall, Sons & Co. have introduced an exceedingly efficient "trip" gear which works two equilibrium admission valves, one on each end of the cylinder ; these are alternately lifted by means of the valve spindles and trip-levers and give an expansive distribution of steam which is automatic, reliable and simple. Where great regularity of speed is necessary, this arrangement of steam distribution has been found to be very satisfactory, and the firm are introducing it on engines for electric lighting, saw-mill and similar work. The firm, we believe, have installed engines, equipped with their valve gear, to supply motive power to the printing machines of several of the

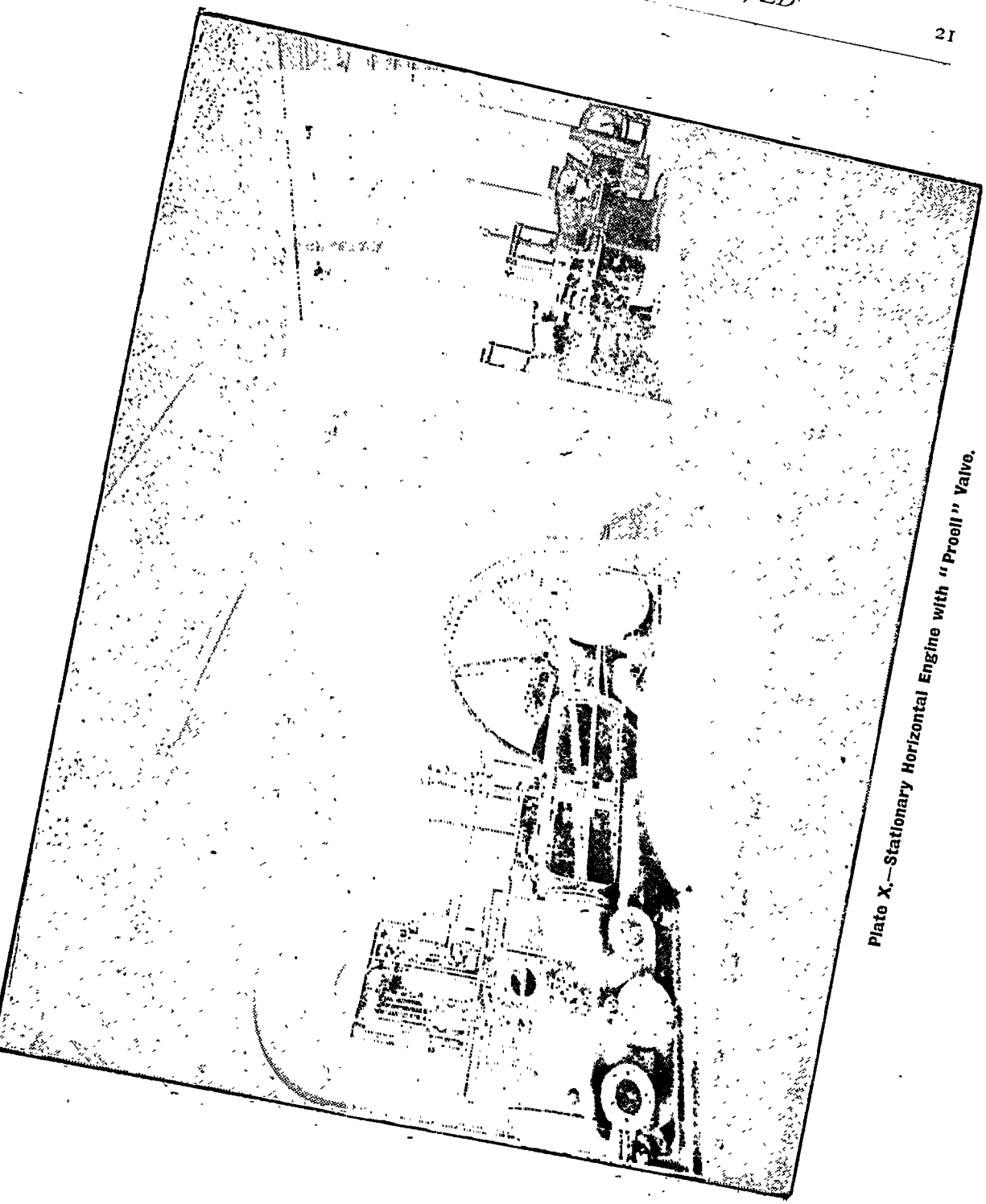


Plate X.—Stationary Horizontal Engine with "Proell" Valve.

principal newspapers in London, and also at the Royal Arsenal at Woolwich, &c., &c. Engines of this type are made in sizes of from 20 up to 500 horse-power. We also illustrate in Plate XI one of the firm's specially arranged Tea Factory Engine installations. This type of engine is exceedingly economical and its compactness makes it a very desirable type for situations where floor space forms a consideration.

In pumps as we have mentioned before, the firm are sole agents in India for the Worthington Pump Company's *specialites*, and have in stock a variety suitable for all purposes; an extremely compact type is one mounted on the one base-plate with a vertical boiler. The department for tea machinery is very well stocked with full plant for the manufacture of tea. Messrs. W. and J. Jackson's tea rollers are much in evidence, and here are to be found five distinct types of the well known and deservedly popular "Rapid" tea rolling machine with square and round, rolling-surfaces, these can be of wood, granite or brass, at the option of the purchaser. Many improvements have been introduced into the construction of these machines, all the parts being so designed as to give the erector the minimum of trouble. Then we have Jackson's latest patent "Paragon" and "Chota Paragon" Tea-dryers, which from all reports are being worked very successfully and have given great satisfaction during the past two years. In tea machinery Messrs. Marshall, Sons & Company have studied the requirements of tea-makers and have made it a point to supply simple, strong and economical motive-power and thoroughly reliable and well-made machines; it is not therefore surprising that the firm who have laid themselves out to cater for the tea-planter regardless of expense, in order to supply him with the most efficient means to carry out his industry in a perfect manner and with due regard to economy, should at their hands receive that appreciation which is justly its due.

In taking leave of Messrs. Marshall & Sons for the present, we must express our opinion, and we are not singular in holding it, that the success and position so rapidly attained by the firm in this country is undoubtedly due in a very large measure to the sterling business capacity of Mr. John Harper, the General Manager, who combines with energy and foresight the popularity so essential to the success of any enterprise in India. Mr.

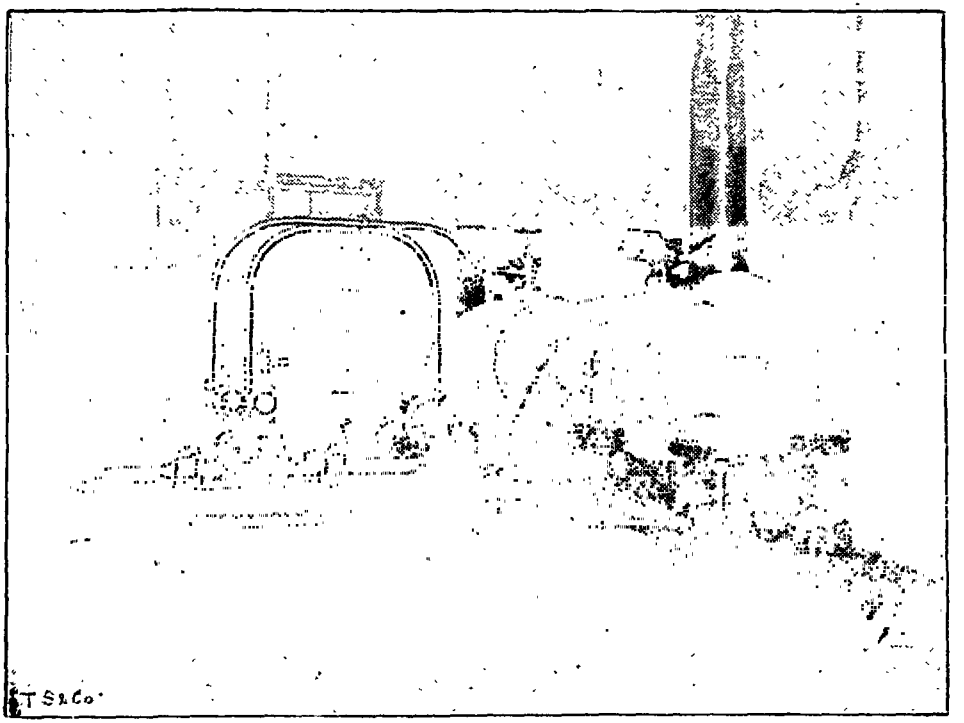


Plate XI.—Arrangement of Tea-House Engine and Boiler.

Harper is, as has already been announced in these columns, just now at Home on a short six months' leave, to recruit after his six years' labours in building up, what all must acknowledge to be, one of the most successful engineering businesses in this country.

The plates which illustrate this notice are reproductions from photographs, and are the work of Messrs. Thacker,

Spink & Co., of 5 & 6, Government Place, Calcutta, who are the Proprietors of the Calcutta Phototype Company. We believe we are correct in saying that this is the first time that reproduction of such photographs by process-work has been carried out by a private firm in this country.

Extract from issue of July 11th, 1896.

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A few details of the stores or godown building referred to on pages 14 and 16 will not be without interest to our readers, the more so that the structure, when first erected, was, of its kind, quite unique in India, and even at this time of writing has not many to equal it. We find ourselves in error in stating that the columns which support the roof trusses are of cast-iron. The whole of the structure, columns, girders, rafters, etc., are of steel and were made at Messrs. A. & J. Main's works at Possilpark, Glasgow, and erected by them here. The godown is 250 feet long over end-columns, the span being 43 feet; there are three ventilators on the roof, each 38 feet by 6 feet with a height of 2 feet. The walls of the building are provided with wrought-iron frame glazed-windows down the side and end, these being pivotted to swing open, while the other side is fitted with fixed windows similarly constructed. All the timber work in the structure is of teak supplied by the Bengal Timber Trading Co., Ld., for whom Messrs. Jardine, Skinner and Compnny, so well known throughout India and the East, are the local agents.

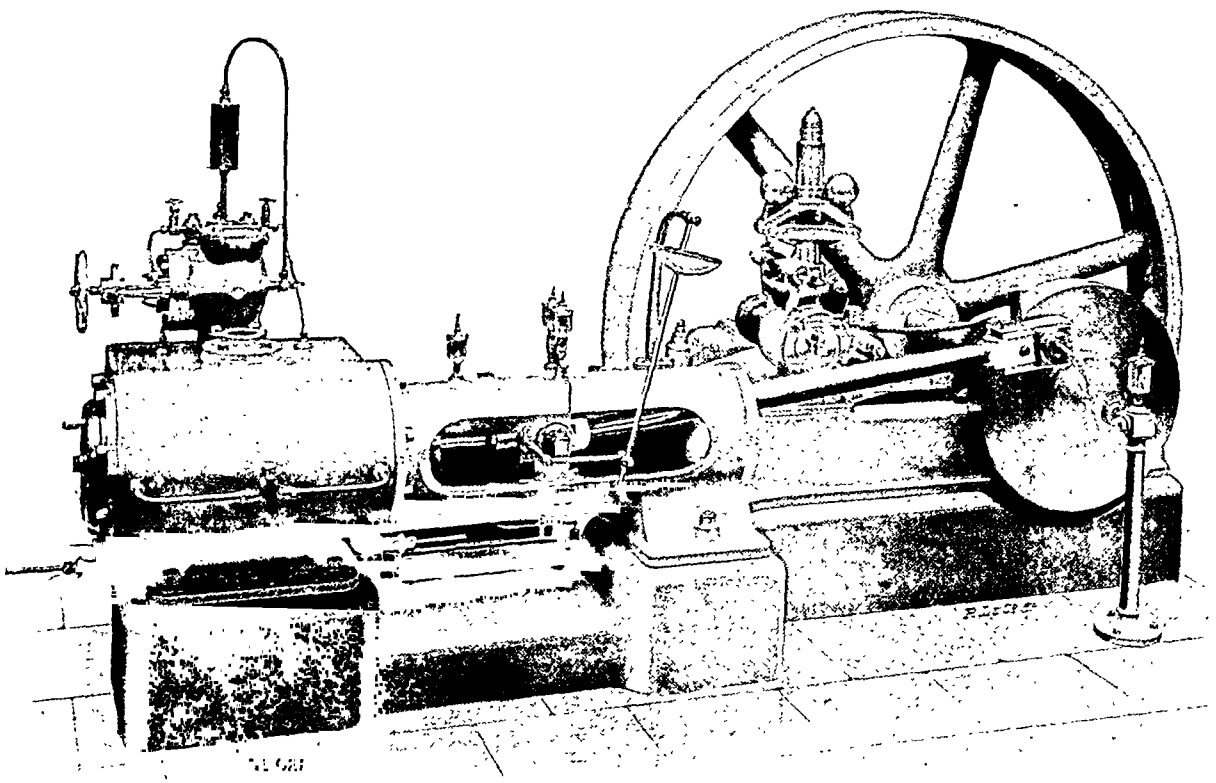
A few words may be said here in respect of the travelling cranes which play so important a part in the firm's business. The main travelling crane is capable of lifting a gross load of 15 tons, and runs on rails which are carried on the main columns at a height of 24 feet 3 inches above the floor. Down one side of the godown runs a raised platform 15 feet broad and 15 feet above floor and carried on one side by the main columns, and at the other by special columns; the 3-ton travelling crane (mentioned in our notice, and shown in the illustration, Plates V and VI) runs on rails carried by the main columns on one side, and the platform just alluded to on the other. A subsidiary travelling crane has recently been erected, which travels under the 15-foot platform, and has its rails supported on the main and special platform columns on each side. These cranes were built at Messrs. Marshall, Sons and Company's Gainsborough Works.

MARSHALL, SONS & CO., LD.

GAINSBOROUGH, ENGLAND,

LONDON AND CALCUTTA.

HORIZONTAL FIXED ENGINE
CLASS "K"



THE ABOVE REPRESENTS A RIGHT HAND ENGINE

FITTED WITH

HARTNELL'S AUTOMATIC EXPANSION GEAR,

MADE IN SIZES FROM

20 TO 180 EFFECTIVE HORSE POWER.

PRICES AND FULL PARTICULARS ON APPLICATION.

This class forms a series of Horizontal Engines ranging from 20 H.P. effective to 180 H.P. effective, of new and recent design, and specially strong for working with 100 lbs. steam pressure per square inch. The characteristic of the design is stability. The cylinder is supported on a broad foot, the main bearing and bed plate are strongly proportioned, and the engines are massive, substantial, and graceful in outline. For smooth, silent running, for freedom from breakdown and expensive repairs, and for ease of management, our Class "K" series is unsurpassed.

The cylinders are of cold blast iron, steam jacketed, the working barrel being a separate liner of specially hard metal, forced into the casing. The ports and clearance spaces are as short as possible.

The stroke of the Engine is in each case at least twice the diameter of the piston. The speed being high, they are very suitable for electrical work, and they are economical in steam consumption.

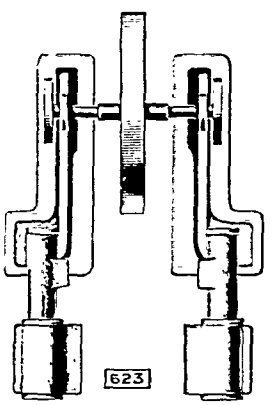
Particular attention is given to proper lubrication of all working parts, including an automatic sight feed lubricator to the cylinder. The steam jacket is kept thoroughly drained through a steam trap of new and improved design.

The governing mechanism consists of a Hartnell's High Speed Governor, in connection with a radial valve gear of simple and efficient design, varying the steam admission from 0 to $\frac{5}{8}$ of the stroke of the Engine, and within a variation of 2% either way from the normal speed.

Adjustments are provided in all parts exposed to wear. The main bearing brasses, through which the whole stress of the working of the Engine is transmitted, are built up in four parts, to permit of accurate adjustment, and the brasses and bearing surfaces are of generous proportions.

Steam stop valve, cylinder drain cocks combined with relief valves, bosses for attaching indicator gear, are included in the equipment. Indicator gear as shown in the illustrations, is extra if required.

The fly-wheels are of ample size, turned to receive double belting, wide enough to transmit the full power of the Engine, and the eccentrics are set so that the top part of fly-wheel revolves from the cylinder, unless otherwise ordered.



The Engine beds are made right or left, and planed on the under surface, all the other parts are similar or reversible. A right-hand Engine means one on the right hand of the fly-wheel, viewed from the cylinder end, thus—

A boiler feed pump, worked by a separate eccentric and fitted with brass valves and seatings, and an air vessel is supplied, when required, at the extra price given in price list.

A pair of right and left Engines may be coupled with the fly-wheel between them. This arrangement, besides insuring extreme steadiness in working, admits of the Engines being readily started in any position, and it will often be found advantageous to put down one Engine so arranged that another can afterwards be added by the side of it when an increase of work renders additional power necessary. When this course is adopted we recommend the first Engine being made with stronger crank shaft, with disc on each end, and a wider fly-wheel capable of giving off the full power of both Engines.

Class "K" retains all the important features—including regularity of running, reliability of working parts, and simplicity of manipulation—that have so long characterised our Class "C" Engines, which have been so popular.

CLASS "K," NON-CONDENSING.

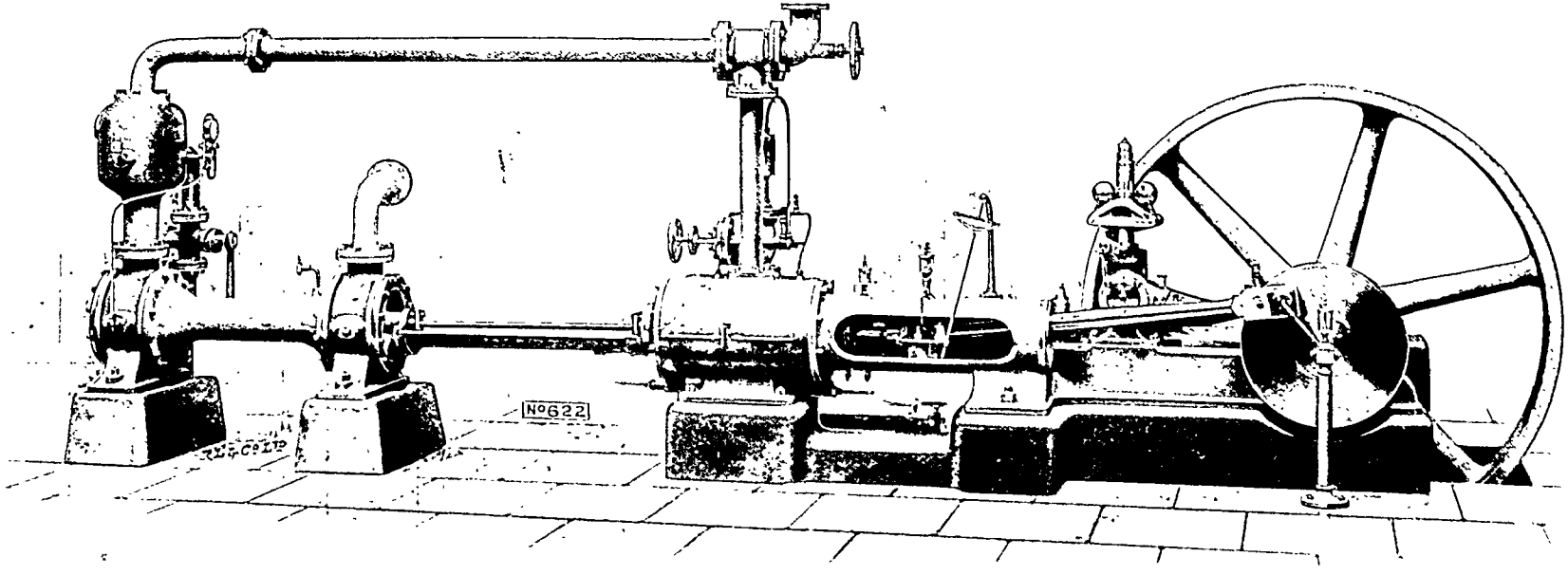
Diameter of Cylinder.	Stroke.	Diameter of Fly-wheel.	Face.	Revolutions per Minute.	Effective Horse Power.			
					80 Lbs. Boiler Pressure.		100 Lbs. Boiler Pressure.	
					Economical load.	Maximum load.	Economical load.	Maximum load.
9	20	7 0	10	120	20	31	22	39
10	20	7 0	10	120	25	39	27	49
11	24	8 0	13	100	31	47	33	59
12	24	8 0	13	100	36	55	40	70
13	30	10 0	15	80	42	65	46	82
14½	30	10 0	18	80	53	82	58	103
16	33 36	12 0	22	66	64	99	70	125
17	33 36	12 0	25	66	73	112	79	142
18	36	12 0	28	66	82	126	89	160

CLASS "KD," CONDENSING.

Diameter of Cylinder.	Stroke.	Diameter of Fly-wheel.	Face.	Revolutions per Minute.	Effective Horse Power.			
					80 Lbs. Boiler Pressure.		100 Lbs. Boiler Pressures.	
					Economical load.	Maximum. load.	Economical load.	Maximum load.
9	20	7 0	10	120	18	37	20	45
10	20	7 0	10	120	23	46	25	56
11	24	8 0	13	100	27	56	30	69
12	24	8 0	13	100	32	66	35	81
13	30	10 0	15	80	38	77	41	95
14½	30	10 0	18	80	48	97	52	119
16	33 36	12 0	22	66	58	118	63	145
17	33 36	12 0	25	66	66	134	71	163
18	36	12 0	28	66	74	150	80	184

HORIZONTAL FIXED CONDENSING ENGINE.

FITTED WITH HARTNELL'S AUTOMATIC EXPANSION GEAR—CLASS K.D.



THIS ENGRAVING REPRESENTS A RIGHT-HAND ENGINE.

Class K.D.—These Engines are of the same type as Class K, but with Horizontal Jet Condensers added, and are constructed of the same sizes, viz., 20 to 180 Effective Horse-Power as Single Engines, and up to 360 Effective Horse-Power Coupled.

The Condensers are of improved construction, suitable for quick speeds, the valve seatings are of brass, with India-rubber valves. The Air Pumps are connected to the tail end of the piston rods, and a suitable distance piece introduced between Cylinder and Condenser, insuring speedy and accurate relative adjustment of these parts in erecting the Engine, an important matter, for abroad especially.

Whenever condensing water is obtainable, by means of a Condenser the consumption of fuel may be reduced to the lowest practicable point in Single-Cylinder Engines. Condensers may be used as a means of increasing the power of the Engine without increasing the steam used.

The above Engine is shown fitted with a valve, so that the Engine may be worked non-condensing if required. This arrangement is very useful where water for condensing purposes is not always available, and can be supplied at an extra cost, if desired.

These Engines are suitable for use in Factories and all other purposes, especially where fuel is dear, cost of power a large item, or where steadiness is required under great and sudden fluctuations of load. The saving in the cost of fuel over good ordinary High-pressure Engines will often exceed in two or three years the whole first cost of the Engine.

Surface Condensers with Brass Tubes are adopted in cases where the condensing water is not suitable for use in the Boiler, or where there is not a sufficient supply of good water available for feeding the Boiler. Prices and particulars of Surface Condensers will be given on application.

MARSHALL, SONS & CO., LD.

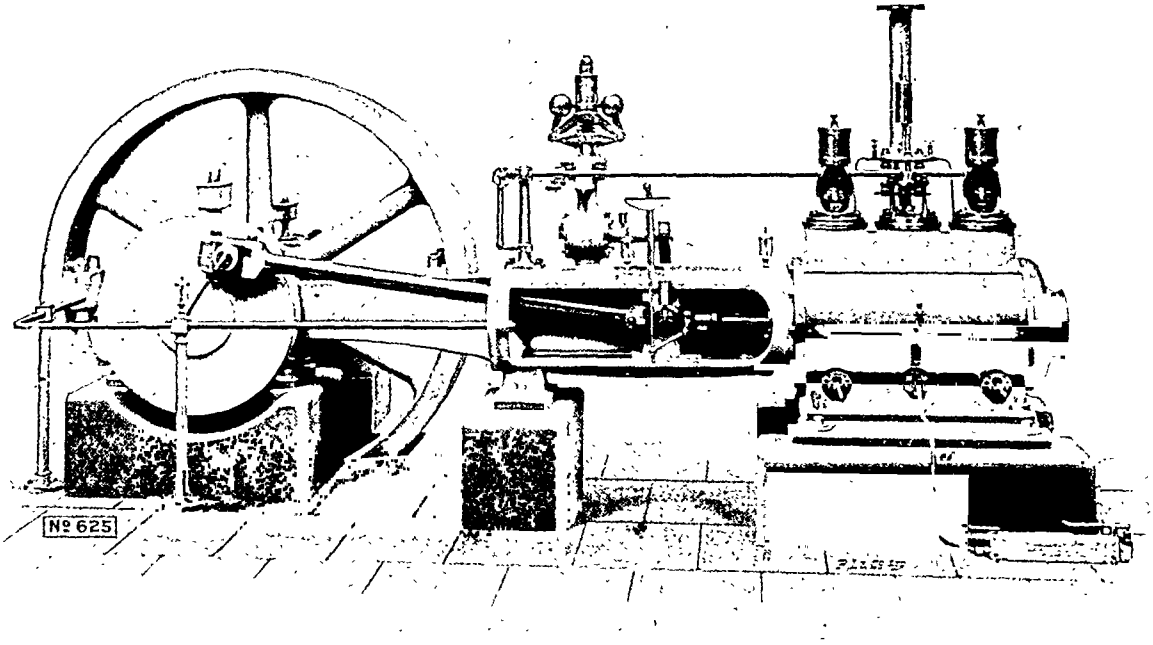
GAINSBOROUGH,

ENGLAND,

LONDON AND CALCUTTA.

HORIZONTAL FIXED ENGINE,

CLASS "L."



THE ABOVE REPRESENTS A SINGLE CYLINDER LEFT-HAND ENGINE FITTED WITH

MARSHALL'S PATENT TRIP GEAR.

THESE ENGINES ARE ALSO MADE COUPLED AND TANDEM COMPOUND
IN SIZES FROM 46 EFFECTIVE HORSE POWER (SINGLE CYLINDER)
TO 650 EFFECTIVE HORSE POWER (COMPOUND).

PRICES AND FULL PARTICULARS ON APPLICATION.

63173-11-00. DE MONTFORT PRESS, LEICESTER. 13076.

HORIZONTAL FIXED ENGINES.

High Pressure—Class "L"; Condensing—Class "LH."
Non-condensing—Coupled Compound, Class "LC"; Tandem—Class "LT."
Condensing—Coupled Compound, Class "LHC"; Tandem—Class "LHT."

These Engines have been specially designed to meet the increasing demand for a high-class Horizontal Engine, and great care has been exercised to cut down the clearance spaces to ensure the utmost economy in steam consumption. They are of ample strength for working with a boiler pressure of 150 lbs. per square inch, and for running at a piston speed of 600 feet per minute.

They have long strokes, steam jacketed cylinders, and very large bearings and wearing surfaces in all parts, fly-wheels of ample weight to ensure steady running, an efficient barring gear, and we include in their outfit foundation bolts and plates. A special Automatic Valve Gear also ensures the greatest economy in the use of steam, and a powerful governor regulates the speed which guarantees uniformity of rotation under extreme variations of load.

The Engines are of the highest class of workmanship throughout, and each Engine is carefully tested under steam, and indicated before leaving the Works. A complete set of case-hardened spanners is provided with each Engine.

The Engine is erected on a massive bed of Corliss pattern, truly faced in the slides, and arranged to form the front cylinder cover at one end, and securely bolted to the crankshaft pedestal carrying the main bearing at the other. The outer end of the crankshaft is carried by a strong cast-iron standard, with an adjustable pedestal, bolted on to a planed wedge. This enables the crankshaft to be kept perfectly level with much greater accuracy, and without the labour of lifting or packing.

The Cylinder is of Cold Blast Iron, with the steam and exhaust valve-chests cast on. The working barrel is cast separately, and is of a special hard mixture of Cold Blast Iron. It is forced into the casting by hydraulic pressure, thus forming a perfect steam jacket which is automatically drained by a steam trap. The steam admission valves are double-beat drop valves, actuated by Marshall's Patent Two-Valve Releasing Gear, as shown in the illustration and fully described on pages 6 and 7. The exhaust valves are of the double-beat type, so designed as to admit of the least possible clearance. Cylinder cocks and relief valves combined are fitted to each end of the cylinder. An improved sight-feed lubricator is provided, and the outer barrel of cylinder covered with non-conducting composition, and cased with sheet steel held in position by polished screws. The necessary stop valve and jacket feed valve are attached to the cylinder.

Indicator gear, with or without the instrument, can be supplied when required, as an extra.

The Crankshaft is of steel, with extra long gun-metal bearings lined with anti-friction metal, one on the crankshaft pedestal and the other on a separate pedestal outside the fly-wheel, both bearings being adjustable. A polished balanced disc is forced on to the end of the crankshaft by hydraulic pressure, and fitted with a steel crank-pin, and this pin is prepared to receive an automatic lubricating arrangement.

The **Connecting Rod** is of steel of ample strength, fitted with massive gun-metal steps at each end, adjustable by means of wedges and screws.

The **Cross-head** is of malleable iron, fitted with adjustable cast-iron slippers of large proportions, and steel gudgeon fitted with lubricator.

The **Fly-wheel** can be turned on the face for belt driving, or grooved for ropes. In either case the fly-wheel is of ample strength and weight to ensure steady running of the Engine, and the valves are set so that the top part of the wheel revolves from the cylinder, unless otherwise ordered. In the larger sizes the fly-wheel is cast in halves for convenience in transit. The fly-wheels of all our standard sizes of these Engines are made with an internal ring of gear, cast in the fly-wheel rim, and suitable **Barring Gear** is included in the price.

We include a **Pillar and Hand Rail** round the disc and connecting rod, and can supply suitable hand railing round the fly-wheel at an extra cost, if required.

The Single Cylinder Engines are recommended to work at 100 lbs. boiler pressure; above that pressure Compound Engines are more economical.

The Engines are made reversible, and this can be effected in a very few minutes should it be found necessary.

COUPLED ENGINES.—When double the amount of power is required without increasing the length, a pair of Engines may be supplied, one each right and left hand, with a crankshaft common to both, and one wide fly-wheel between them. If desired, one Engine can be put down first, and the second added subsequently when the increase of power renders this necessary.

COUPLED OR TANDEM COMPOUND ENGINES.

In addition to the Single-cylinder Engines previously described, we also supply **Compound Engines**, either **Coupled** or **Tandem** type, of various sizes, capable of giving off from 104 E.H.P. at 80 lbs. pressure condensing, and 111 E.H.P. at 100 lbs. pressure non-condensing to 650 E.H.P. condensing at 140 lbs. steam pressure.

In these Compound Engines, whether Coupled or Tandem, the condenser may be either at the tail end of the cylinder as shown on page 4, or what we term the "downstairs" type, *i.e.*, fixed below the engine-house floor at the end of the engine bed, and the air pump worked by a continuation of the piston rod, connected to a wrought-iron L lever coupled to the air pump.

NOTE.—When enquiring about or ordering Engines please give the following particulars:—

State whether Right or Left Hand Engine is required, *i.e.*, is the engine bed to be on the right-hand or the left-hand side of the fly-wheel when looking from the cylinder end.

Whether top of fly-wheel is required to revolve from or towards the cylinder.

Whether the fly-wheel is required for ropes or belt driving.

If any alteration is required in the speed of the Engine.

Boiler Pressure available.

Whether steam piping is to be overhead or below the floor.

Whether sufficient water is available for condensing, and depth of water below engine-house floor.

If Engine is required for Electric Traction or Motor Driving, this should be named in the enquiry.

EFFECTIVE HORSE POWER.

CLASS L. NON-CONDENSING.

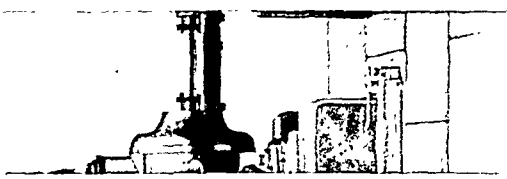
Cylinder.		Revs. per Min.	Fly-wheel.		Boiler Pressure 80 lbs.		Boiler Pressure 100 lbs.	
Diar.	Stroke.		Diar.	Face.	Econl.	Maxm.	Econl.	Maxm.
11″	26″	116	9′		37	56	41	75
12″	26″	116	9′		44	67	49	88

CLASS LH. CONDENSING.

Cylinder.		Revs. per Min.	Fly-wheel.		Boiler Pressure 80 lbs.		Boiler Pressure 100 lbs.	
Diar.	Stroke.		Diar.	Face.	Econl.	Maxm.	Econl.	Maxm.
11″	26″	116	9′		33	66	37	84
12″	26″	116	9′		39	78	44	99

SING

IP GEAR.



INE.

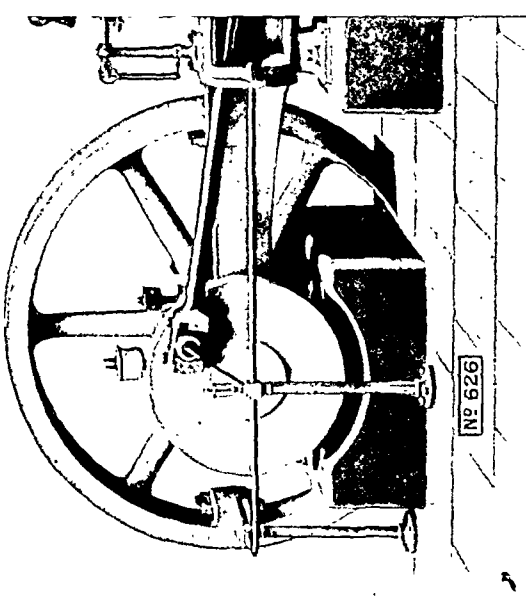
ut with a he
ith an air p
on valve, fo
r required,
-pressure b
he consump
reasing the
condenser,
nps, for use

CLASS LC & LT. COUPLED COMPOUND, & TANDEM. NON-CONDENSING.

Cylinders.			Revolutions per Minute.	Fly-wheel.		Boiler Pressure 100 lbs.		Boiler Pressure 125 lbs.		Boiler Pressure 140 lbs.	
HP.	LP.	Stroke.		Diar.	Face.	Economical.	Maximum.	Economical.	Maximum.	Economical.	Maximum.
11″	19″	26″	116	10′		94·5	105	105	139	109	154
12″	21″	26″	116	10′		116	127	128	169	132	188

HORIZONTAL F

FITTED WI



THE AE

Class "LH."—These Engines are of
at the tail end of the cylinder, as shown ab
of the piston rod through the back cylin
but no injection or overflow pipes. An e
case of any scarcity of condensing water t
Where a sufficient supply of water is avail
considerably by the addition of a condens
condensing water is too deep down to be
supplied. Surface condensers, with brass
can be supplied if required.

EFFECTIVE HORSE POWER.

CLASS L. NON-CONDENSING.

Cylinder.		Revs. per Min.	Boiler Pressure 80 lbs.		Boiler Pressure 100 lbs.	
Diar.	Stroke.		Econl.	Maxm.	Econl.	Maxm.
11	30	110	40	65	43	81
12	30	110	48	76	51	97
13	36	100	60	97	61	123
14½	36	100	75	123	78	154
16	42	86	90	148	94	187
18	42	86	115	189	120	240
20	48	75	142	233	148	296
22	48	75	172	281	179	358

CLASS LH. CONDENSING.

Cylinder.		Revs. per Min.	Boiler Pressure 80 lbs.		Boiler Pressure 100 lbs.	
Diar.	Stroke.		Econl.	Maxm.	Econl.	Maxm.
11	30	110	37	77	41	95
12	30	110	45	90	48	111
13	36	100	57	116	61	142
14½	36	100	72	145	78	180
16	42	86	87	177	94	217
18	42	86	111	225	120	276
20	48	75	137	278	148	341
22	48	75	166	335	179	411

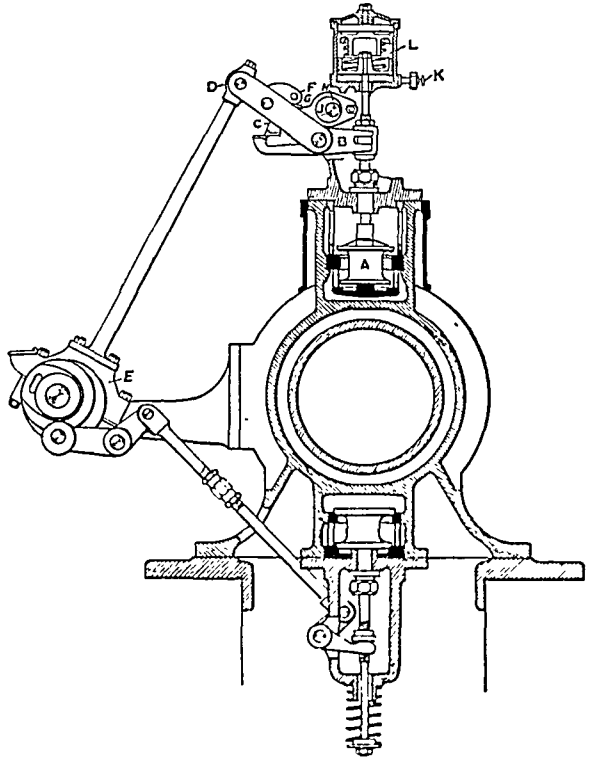
CLASS LC & LT. COUPLED COMPOUND, & TANDEM. NON-CONDENSING.

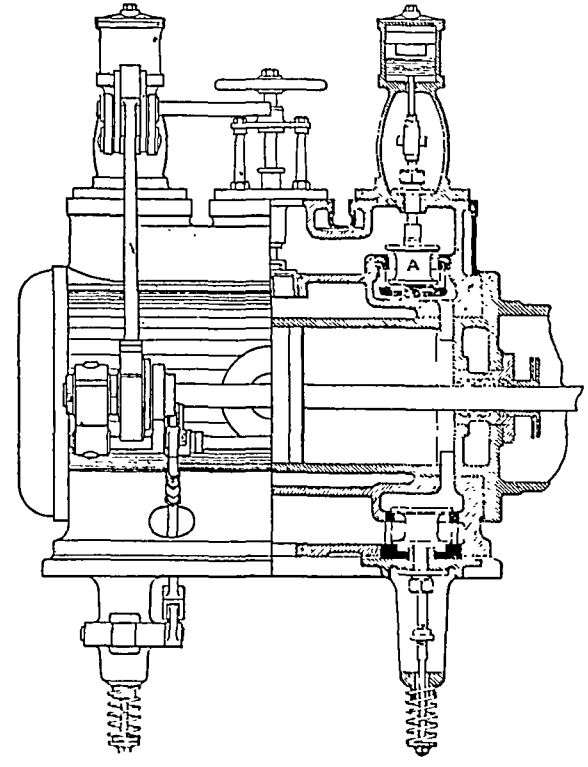
Cylinders.			Revolutions per Minute.	Boiler Pressure 100 lbs.		Boiler Pressure 125 lbs.		Boiler Pressure 140 lbs.	
HP.	LP.	Stroke.		Economical.	Maximum.	Economical.	Maximum.	Economical.	Maximum.
11	19	30	110	106	118	117	156	120	171
12	21	30	110	129	143	143	188	146	212
13	22½	36	100	162	177	179	235	183	262
14½	25	36	100	200	220	220	292	226	325
16	28	42	86	252	275	277	366	284	410
18	32	42	86	330	360	360	472	371	532

CLASS LHC & LHT. COUPLED COMPOUND, & TANDEM. CONDENSING.

Cylinders.			Revolutions per Minute.	Boiler Pressure 80 lbs.		Boiler Pressure 100 lbs.		Boiler Pressure 125 lbs.		Boiler Pressure 140 lbs.	
HP.	LP.	Stroke.		Econl.	Maxm.	Econl.	Maxm.	Econl.	Maxm.	Econl.	Maxm.
11	19	30	110	99	122	111	154	120	190	126	213
12	21	30	110	122	149	136	186	145	231	152	261
13	22½	36	100	152	185	170	232	182	287	190	326
14½	25	36	100	190	230	210	290	225	360	237	403
16	28	42	86	245	288	262	360	283	450	295	508
18	32	42	86	307	375	342	470	367	585	385	652

MARSHALL'S PATENT TRIP GEAR.





FOR FULL DESCRIPTION SEE OPPOSITE PAGE.

MARSHALL'S PATENT TRIP GEAR.

The accompanying illustration represents a section of a cylinder fitted with Marshall's Patent Trip Gear.

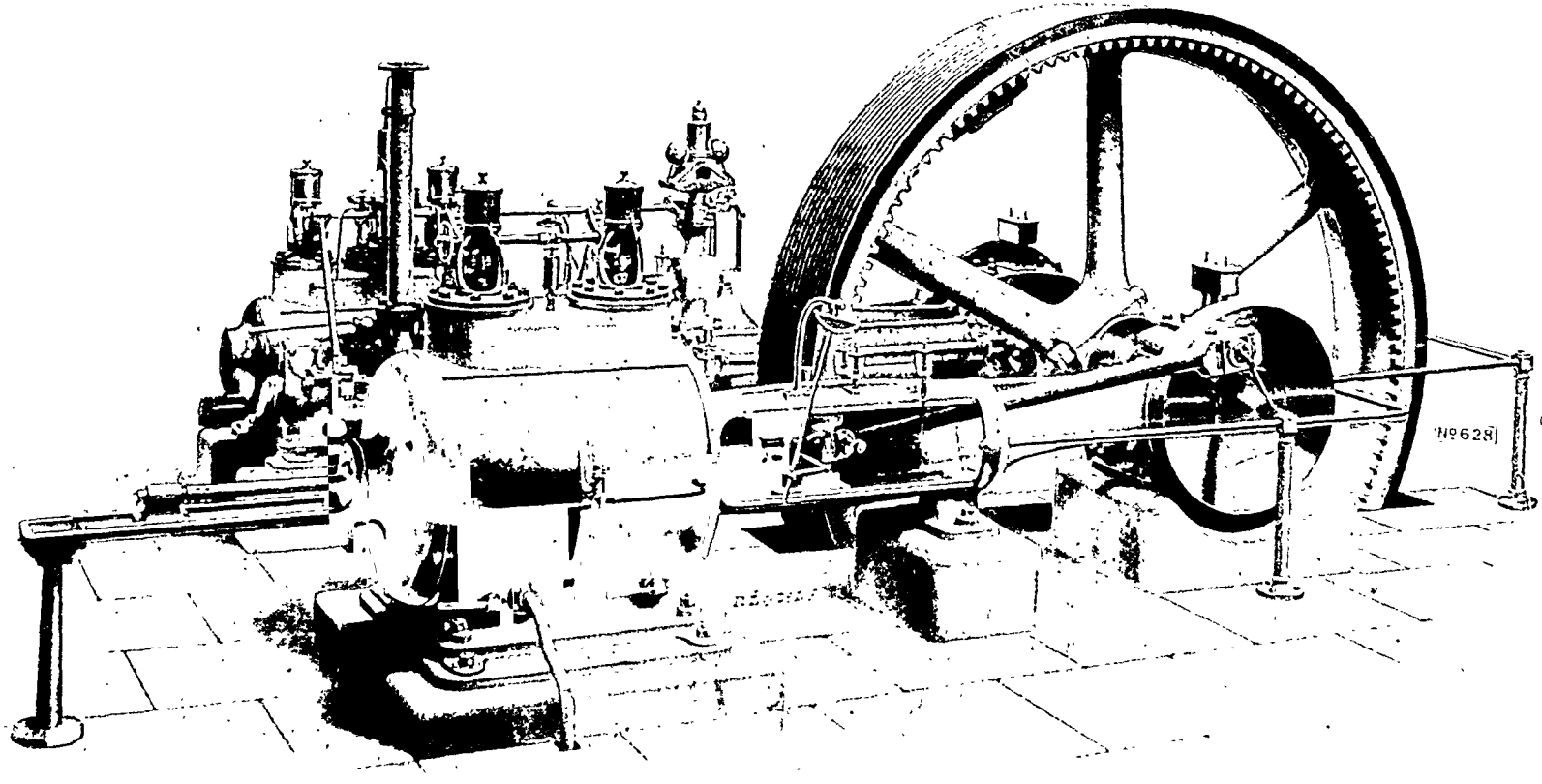
The gear consists of two equilibrium admission valves "A" one to each end of the cylinder. These are alternately lifted by means of the valve spindle in connection with the trip levers "B." These trip levers are depressed by means of the L levers "C" which are connected to the links "D" worked from eccentrics "E," keyed on a lay shaft which receives its motion through gearing from the engine crankshaft. The ends "F" of the L levers projecting inwards are brought into contact each revolution of the Engine with trip pads "G." These trip pads are connected with governor through the medium of the eccentrics "H" and the shaft "J" and the position of the pads determines the amount of cut-off of the steam, for as soon as the ends "F" of the L levers reach the trip pads any further movement of the links "D" disengages the L levers from the trip levers "B" and the valves immediately close. The closing speed of the valves can be very readily regulated by means of the air valves "K" in connection with the spring boxes "L," so that although they close very rapidly they do so quietly, thus preventing any undue wear of the valves or faces. All the working parts of this gear are case-hardened and the cutting off edges are made of specially hardened material.

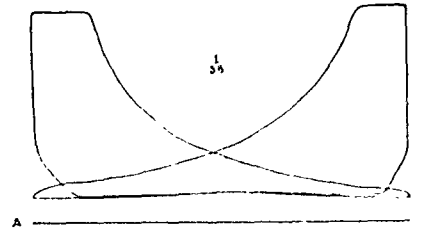
The Governor controlling this gear is of a very powerful and sensitive type and has a range to regulate the cut off at any point from nothing up to $^5/_8$ of the stroke of the Engine. It is fitted with a special adjusting gear so that the speed of the Engine may be varied 5 % either way from the mean whilst the Engine is running. This is a point of considerable importance for many classes of work, and enables the speed of the Engine to be most accurately adjusted.

The exhaust valves are of the double beat type actuated by cams keyed on to the same lay shaft which carries the eccentrics for working the trip gear.

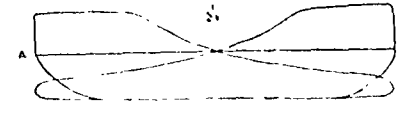
COUPLED COMPOUND ENGINE.

WITH MARSHALL'S PATENT TRIP GEAR.





HIGH PRESSURE DIAGRAM.



LOW PRESSURE DIAGRAM.

MARSHALL, SONS & CO., LIMITED, GAINSBOROUGH.

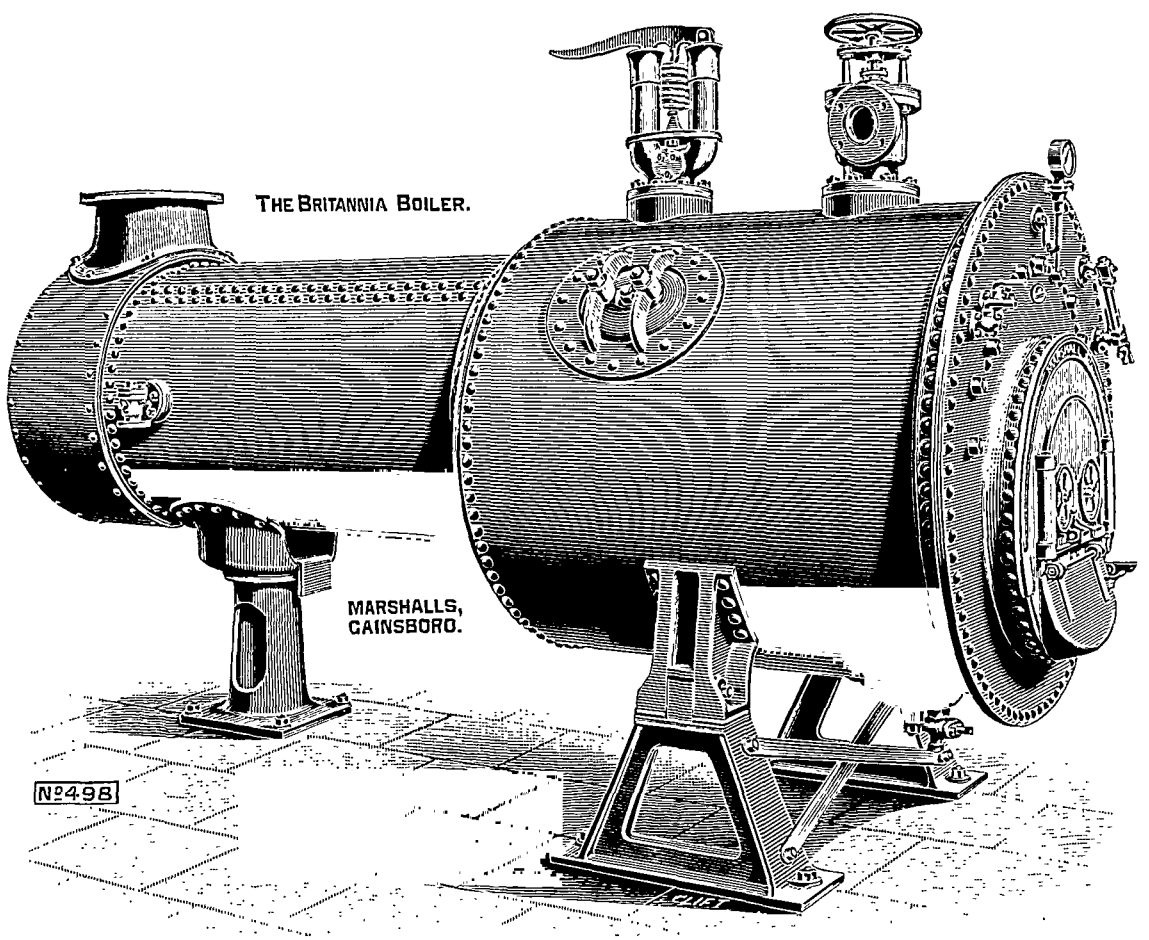
MARSHALL, SONS & CO. LTD

Britannia Iron Works

GAINSBOROUGH, ENGLAND

MARSHALL'S BUILDINGS, 79 FARRINGDON ROAD, **LONDON**

99 CLIVE STREET, **CALCUTTA,** AND 8 HUMMUM STREET, **BOMBAY**



THE "BRITANNIA" BOILER

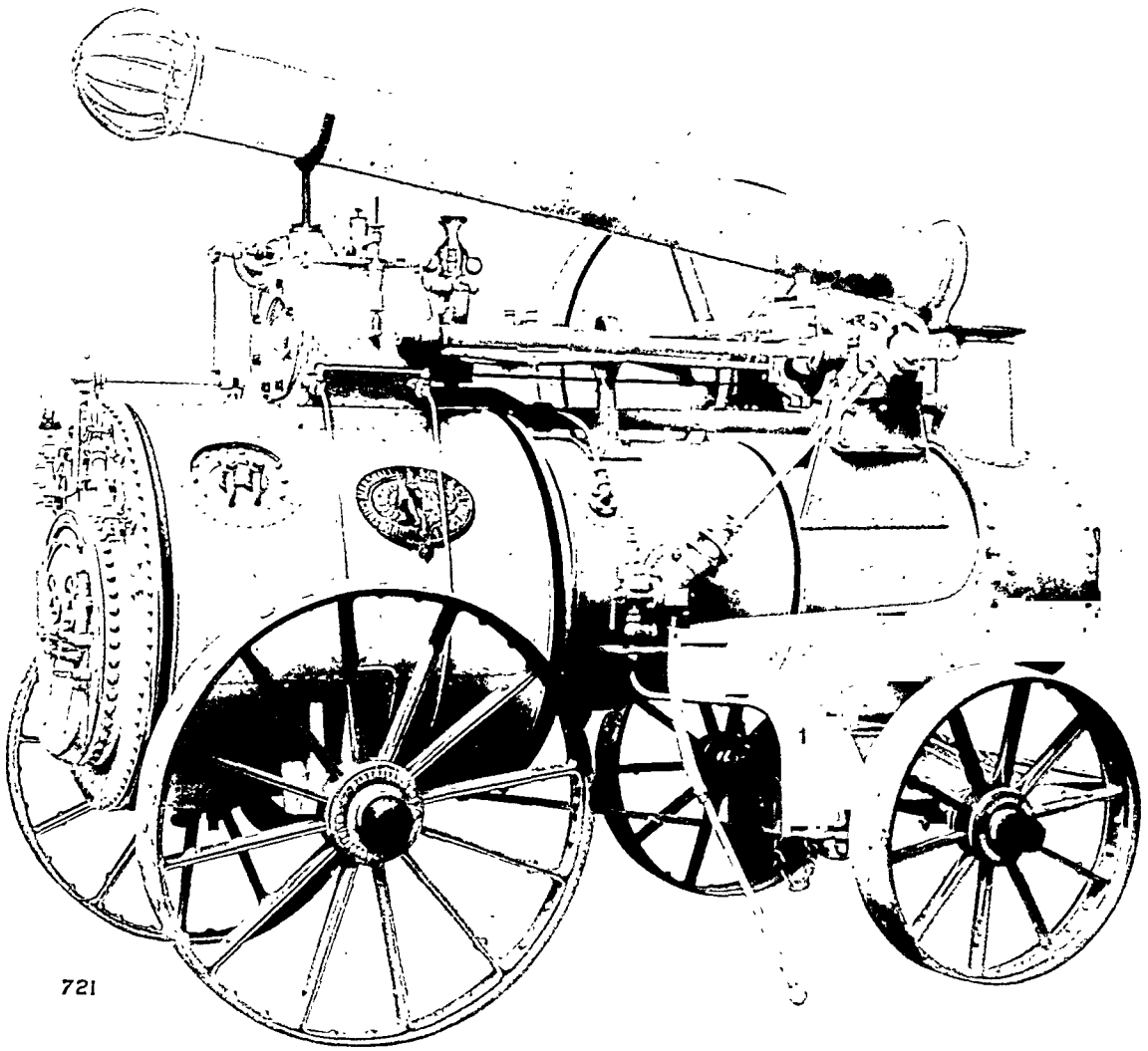
72722-5-02 JOHN BELLOWS, GLOUCESTER 228715

MARSHALLS'

NEW PORTABLE ENGINE

ON

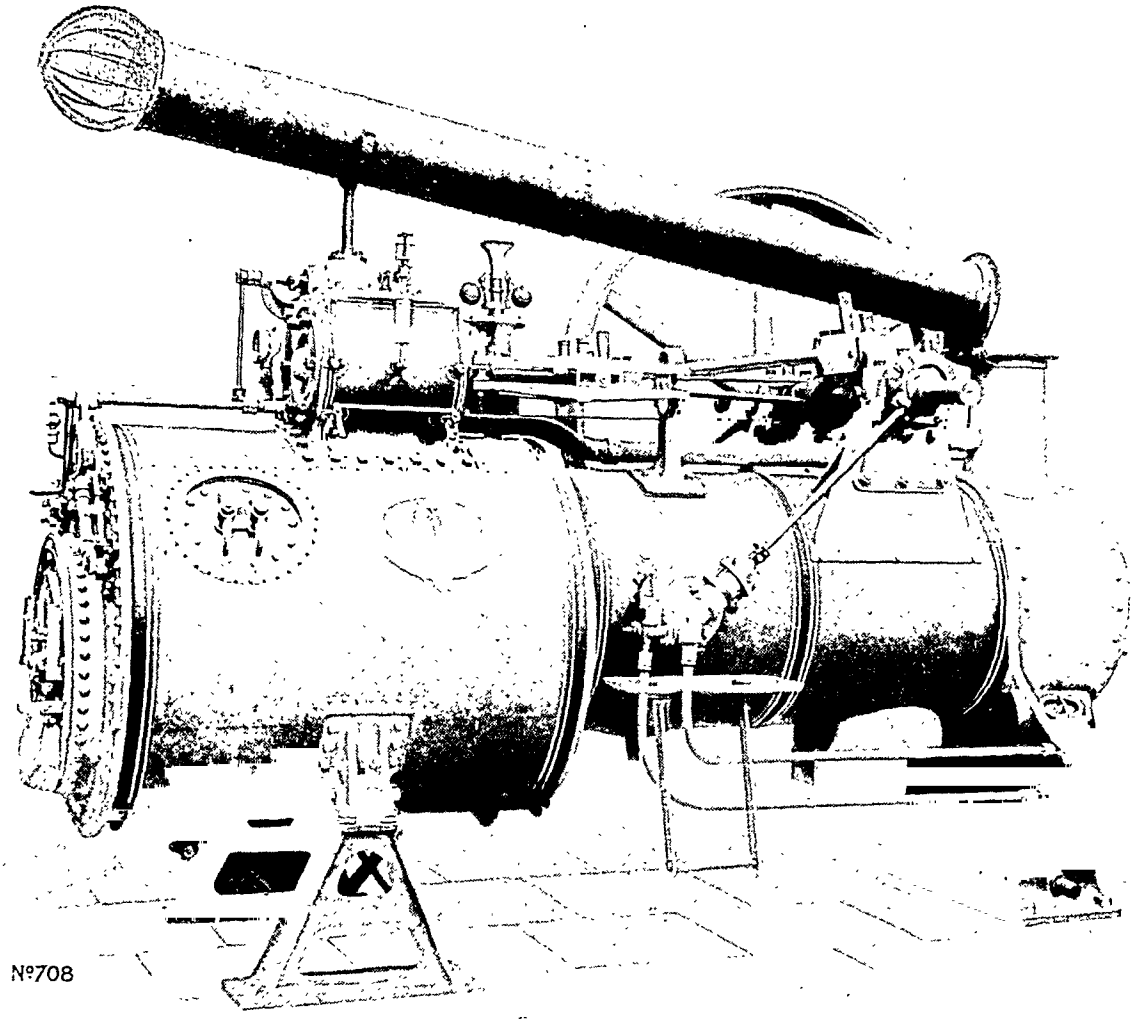
THE "BRITANNIA" BOILER



The above Illustration is taken from a Photograph of a **12** HP. Engine with Cylinder mounted on planed steel castings as made from **10** to **14** HP.

Prices and full Particulars on application

MARSHALLS'
NEW SEMI-PORTABLE ENGINE
ON
THE "BRITANNIA" BOILER



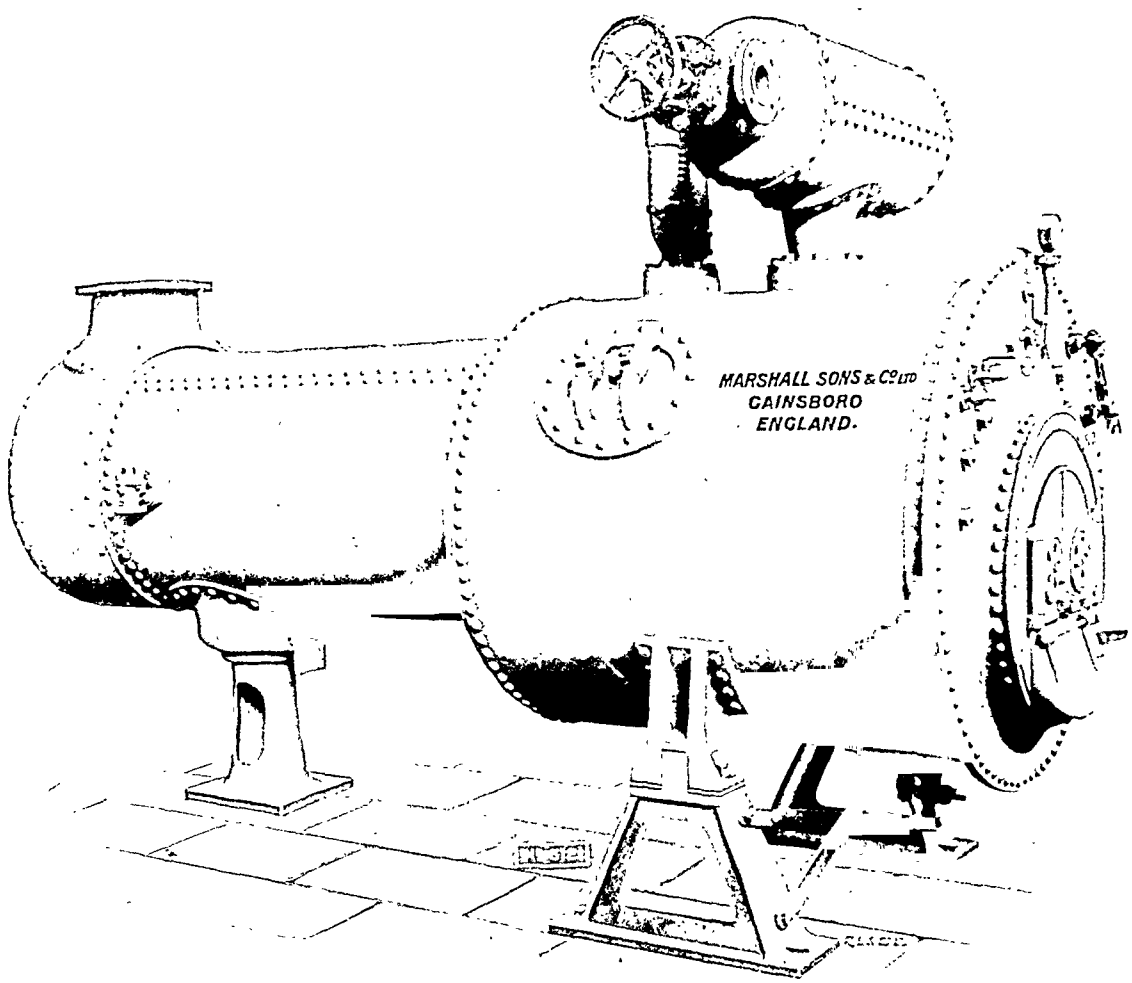
№708

The construction of these Engines is the same as those of the Portable type described on pages 2 to 4, but they are mounted on castings instead of travelling wheels and undergear. Both the Portable and Semi-Portable Engines are made from 4 to 14 H.P. inclusive, and they can be supplied with or without the supporting castings, as may be desired. Our list price now includes the castings under the fire-box, but instead of the pedestal formerly used under the smoke-box we now include a Tank, as shown above, with copper coil for heating the feed water without allowing same to come into direct contact with the exhaust steam.

Where water is plentiful a Condenser may be added with beneficial results, as it increases the power given off by the Engine with the same consumption of fuel. The Condenser is attached to the side of the Boiler, and the arrangement is thus compact and self-contained.

Prices and full particulars on application

THE "BRITANNIA" BOILER



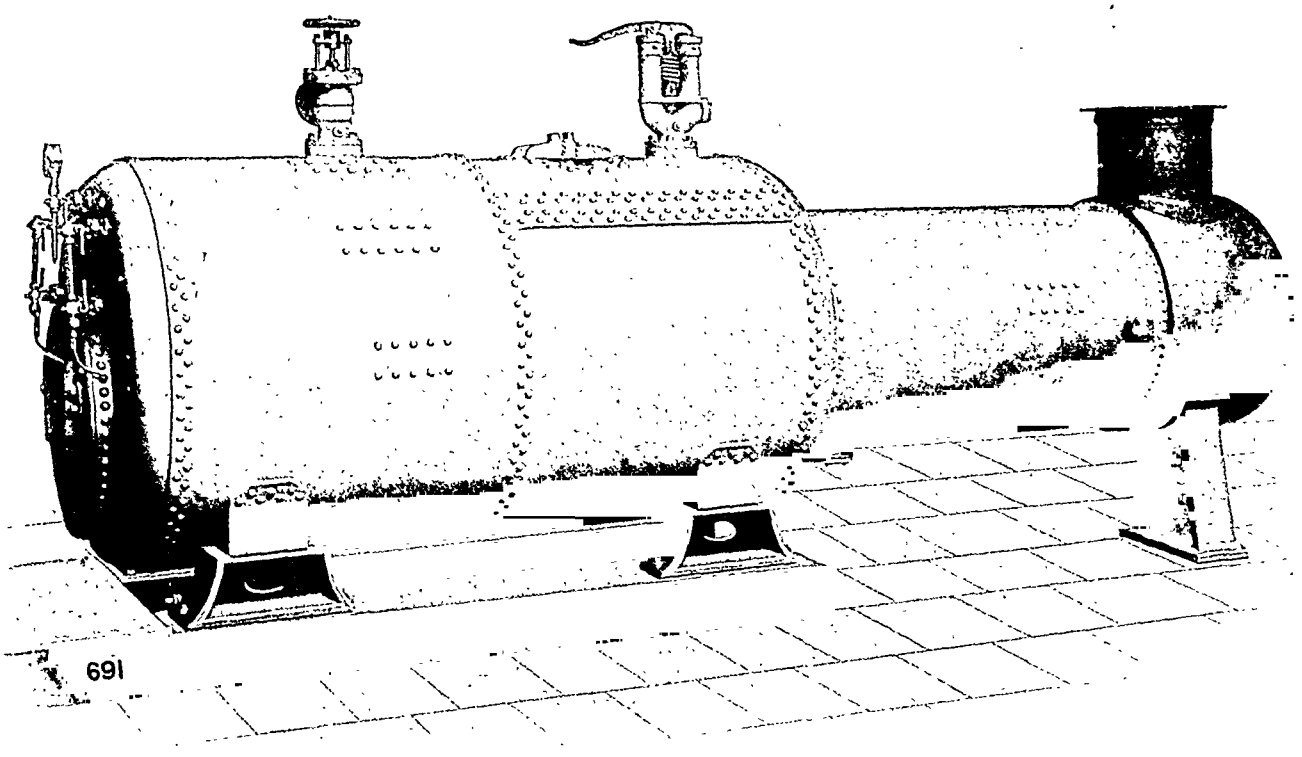
These Boilers are suitable for supplying steam to separate Fixed and other Engines, and, as will be seen from the description given on page 3, they embody many of the advantages of our Cornish Multitubular Boilers, without requiring any brickwork setting. Owing to the circular form of the outer shell, and the absence of stays between the shell and fire-box, they are more suitable than the ordinary Loco. Boilers for working with bad feed water.

This type of Boiler is made in 10 sizes from 4 to 30 H.P. inclusive, suitable for **100 lbs.** pressure.

We recommend a Horizontal Steam Drum, as shown above, and this is bolted to the steel fixing on the top of the Boiler, so that it can readily be detached for shipment. We include this Steam Drum with Boilers of 10 H.P. and upwards, but it is not supplied with the smaller sizes (see front page) except at an extra charge.

Prices and full Particulars on Application.

SPECIAL "DREDGER" BOILER



We have given the matter of Boilers our most careful consideration, and the above represents a type of Boiler specially designed for use on Gold Dredges, but they can also be used with advantage for other classes of work. We construct them of Steel of ample strength for **140 lbs.** working pressure, and make them in various sizes from 14 to 30 N.H.P. The boiler is circular throughout, and therefore stays between the inner and outer fire-box are not required, thus making it more easy to clean and consequently less liable to deteriorate with bad feed water than the ordinary boiler of the locomotive type. We think our dredging friends will fully appreciate the advantages of a boiler made to our design, as the water available is frequently not of the best. These boilers can also be fired with rough wood logs as fuel. The fire-box is specially proportioned to meet all requirements as to inferior fuel, and this Boiler has given unqualified satisfaction in this respect in all parts of the world.

Our "Dredger" type Boilers can be easily mounted on board the dredges, or put down on an ordinary floor, and they are supplied with a full set of first-class fittings and mountings.

Prices and full Particulars on Application

TESTIMONIALS

(COPY)

PERSEVERANCE BATTERY
CLARKES & STONEY CREEK
WINDEYER, N.S.W.

To Messrs James Martin & Co., Sydney, N.S.W. October 5th, 1896

Gentlemen,

After giving the "Britannia" Engine, 5 H.P., a fair trial, I deem it a pleasure on behalf of my partners and yourselves to certify that the "Britannia" Engine, 5 H.P., by Marshall & Sons, Gainsborough, England, sold by you to burn logs of four feet long, has proved an unqualified success. She drives a five head Stamper Battery (7 cwt. stamps) with 40 to 50 lbs. of steam, also the pump attached to stamp shaft with the greatest ease, and only about three-quarters of her power at that pressure. She consumes about half or three-quarters of a cord of wood in 24 hours, and the principal part of that is green. Once she gets any heat on to her she requires very little attention, in fact, literally speaking. she (The "Britannia") is a perfect gem.

I can safely recommend her to any person requiring a first-class Engine. Our engineer considers the Engine the best ever he had anything to do with, and he has had twenty years' experience.

We feel greatly pleased in signing this as genuine.

Yours faithfully

CLASS LHC & LHT. COUPLED COMPOUND, & TANDEM. CONDENSING.

Cylinders.			Revolutions per Minute.	Fly-wheel.		Boiler Pressure 80 lbs.		Boiler Pressure 100 lbs.		Boiler Pressure 125 lbs.		Boiler Pressure 140 lbs.	
HP.	LP.	Stroke.		Diar.	Face.	Econl.	Maxm.	Econl.	Maxm.	Econl.	Maxm.	Econl.	Maxm.
11"	19"	26"	116	10'		88·5	110	100	137	108	170	113	190
12"	21"	26"	116	10'		108	133	122	166	130	207	135	233

working at this farm for the past twelve months, during which time it has been used for driving the Thrashing Machine, Circular Saw, Chaff Cutter and Corn Grinding Mill.

It has always worked most satisfactorily in every way, not one single hitch having occurred since it was first started. The Engine runs very smoothly, shewing exceedingly light friction, and is so simple in working that any student can manage to drive it after one hour's instruction.

I consider it the best Engine I have seen for general farm work, as in addition to the qualities above mentioned, the consumption of fuel and water is so small, and the new round barrel fire-box makes it unusually suitable for moving about from paddock to paddock.

Yours faithfully

(Signed) GEORGE VALDER
Manager

(COPY)

ORANGE, N.S.W.

To Messrs James Martin & Co., Sydney

Gentlemen,

The Marshalls' New "Britannia" Engine I got from you is giving me every possible satisfaction. I have been working it every day for the last fortnight. It is splendidly governed, and well able to drive my cutter with 50 lbs. of steam.

Yours faithfully

(Signed) J. HOOLAHAN

(COPY)

DUBBO, N.S.W.

To Messrs James Martin & Co., Sydney January 7th, 1898

Dear Sirs,

The "Britannia" Portable Engine is the best in this district, and it is the proper sort of Engine for farm work. There are other Portable Engines round here, but mine is simpler and stronger. The log burning fire-box enables me to burn wood double the length that other Engines take.

The "Britannia" Engine is safer from fire, which the people I have been cutting for like very much. I could run her into a bed of straw without much danger of fire, but it could not be attempted with ordinary kind of Portables, as the ash-pans on them would let cinders through. She is very light to draw from place to place, and as the fire-box is high up I could travel over roads where other Portable Engines would be left.

(Signed) MICHAEL J. COLBRON

(COPY)

KIRNDEEN
CULCAIRN, N.S.W.

July 15th, 1898

Messrs James Martin & Co., 161 Clarence Street, Sydney

Gentlemen,

With reference to the 7 H.P. "Britannia" Portable Engine which I got from you nearly three months ago, I wish to tell you that I am most pleased with it.

Having had experience extending over 20 years with Portable Engines on stations, I freely admit that I have not seen its equal.

The advantage of the "Britannia" fire-box is undoubted, and altogether the Engine works perfectly; but the most surprising part of it is the extraordinary small amount of fire that it takes to work her. We can keep her going with an ordinary double handful of chips. I don't know if all your new Engines are like this, but this one certainly is surprising to me.

I shall strongly recommend this kind of Engine to my friends, and I thank your firm for the particular Engine they procured me.

Yours truly

(Signed) ALEX. MCBEAN

(COPY)

RICHMOND, N.S.W.

July 22nd, 1898

Messrs James Martin & Co., 161 Clarence Street, Sydney

Gentlemen,

We bought from you about six weeks ago for a customer of ours one Marshalls' new "Britannia" Portable Engine, and we have pleasure in stating that the Engine has given more satisfaction than we ever anticipated.

It has been at work ever since we got it, and the man working it says that he has worked Portable Engines for years of various makes. and that he has never got such satisfaction before.

It has been shewn to several who have Engines in this District, and they all express their views strongly in favour of this one, and we feel certain that success must attend your effort in putting a first-class Portable Engine like this on the market.

We might state that two horses can take it anywhere in our district, and that it burns very little fuel.

Yours truly

(Signed) WOODHILL & COY.

(COPY)

TRAVELLING AGRICULTURAL INSTRUCTOR,
J. L. THOMPSON,
ENFIELD, P.O., N.S.W.

Benjamin K. Morton, Esq., November 28th. 1898
65 Post Office Chambers, Pitt Street. Sydney

My dear Sir,

I was very pleased to receive your letter dated Melbourne. 23rd November current. I would only be too glad to give you every possible testimony as to the value of Marshalls' "Britannia" Portable Engine and Boiler. I think this is the same as we have got at the dairy at the H.A. College Farm, and I have no hesitation in saying that it has now been in continual use for six years, and it has given us entire satisfaction. I am certain they are very durable, and in practical use there is quite enough circulation below the fire-box.

Yours most sincerely

(Signed) J. L. THOMPSON

(COPY)

DERRIBONG STATION,
DANDALOO, N.S.W.

June 5th. 1899

Messrs James Martin & Co., 161 Clarence Street, Sydney

Dear Sirs,

Referring to yours of the 2nd inst., as to how I am satisfied with the two Marshalls' "Britannia" Portable Engines supplied to me by you for this Station and Tabratong, I am pleased to say they have given every satisfaction. The one supplied to me last July has been running constantly ever since, and has never had the slightest thing wrong with it. and started easily from the first day. They consume very little fuel, and the whole finish of the Engine is very good.

Yours faithfully

(Signed) CHARLES MACKINNON

(COPY)

BROULA, COWRA

August 26th, 1899

Messrs James Martin & Co., Sydney

Gentlemen,

Referring to yours of the 22nd inst., as to how we like the 8/9 H.P. Marshalls' Portable "Britannia" Engine, which we purchased from you, we are pleased to state she is working splendidly, and we cannot help expressing our feelings to you for the entire satisfaction she gives us, both in work and other points. The whole construction is wonderfully made, especially the boiler and fire-box. The latter takes wood 4 ft. 9 in. in length. Another splendid point is that she can be drawn about in boggy ground without anything catching; also I can say that through her requiring so little attention, we are saving nearly a man's wages.

I am, yours respectfully

(Signed) ERNEST S. TWIGG

(COPY)

September 15th, 1899

To Messrs James Martin & Co., 161 Clarence Street, Sydney

Dear Sirs,

I have much pleasure in stating that the Marshalls' "Britannia" Portable Engine that I purchased from you over twelve months ago has been in continuous work, and gives me the utmost satisfaction.

The "Britannia" is unquestionably the best Portable Engine I have seen, and my experience extends over many years, in fact I have had two other makes of Portable Engines in use. She is the best Engine to steam that I have seen, burns very little fuel, and I save considerably in being able to burn long logs of wood. The facilities for cleaning the boiler are better than on an ordinary Portable Engine.

If anyone contemplates purchasing an Engine, you may refer them to me, and I will confirm what I now say. I am ordering another Portable Engine from you, as I am satisfied that it is not possible to get any other more suitable for agricultural work.

I am, yours truly

(Signed) JOSEPH HULL

Dubbo

(COPY)

THE MOOR HOUSE, HEREFORD

October 26th, 1899

Gentlemen,

You may probably be glad to hear the Engine you shipped for me in May last to Townsville (Queensland) arrived at Masovelton Station just in time.

We had erected 46 new Wolseley's Machines, and the whole thing was started without a hitch or slightest delay in shearing.

The Engine is doing its work well, and am pleased to say giving every satisfaction.

They also further write that it is very economical in way of wood, which is an important matter in that particular district.

I am, Gentlemen

Yours faithfully

(Signed) W. T. CHAVE

Messrs Marshall, Sons & Co., Ltd., Gainsborough

(COPY)

BEN LOMOND

10th April, 1901

Messrs James Martin & Co., 161 Clarence Street, Sydney

Gentlemen,

The Marshall "Britannia" Log Burning Engine, which we purchased from you, has been working in this district for some time, during which time it has been used for driving the Thrashing Machine. It has always worked most satisfactorily in every way, not one single hitch having occurred since it was first started.

The Engine runs very smoothly, showing exceedingly light friction, and is so simple in working that anyone can manage to drive it after one hour's instruction, and uses very little water to what some other Engines do.

We are, Sirs, yours respectfully

(Signed) E. & J. W. HODDER BROS.

Ben Lomond

(COPY)

WAUGOOLA

March 28th, 1902

Messrs James Martin & Co., 161 Clarence Street, Sydney

Dear Sirs,

The Marshall's "Britannia" Portable Engine, recently purchased from you, has given every satisfaction, being easy to manage and using very little wood and water, and also being very handy to move about.

I think it the best Portable Engine on the market.

Yours respectfully

(Signed) F. C. ROWLANDS

(COPY)

WALLENDBEEN

4th April, 1902

Messrs James Martin & Co., 161 Clarence Street, Sydney

Dear Sirs,

I am well pleased with Marshall's "Britannia" 6 H.P. Engine, which has done work splendidly with no trouble at all.

I can recommend the Marshall's Engine to any one wishing to buy one, and I am sure they will not be sorry for it.

She drives a four-knife wheel 14" face chaff cutter, and supplies steam for a steamer which is constantly going all day.

Yours faithfully

(Signed) JOHN J. HOOD

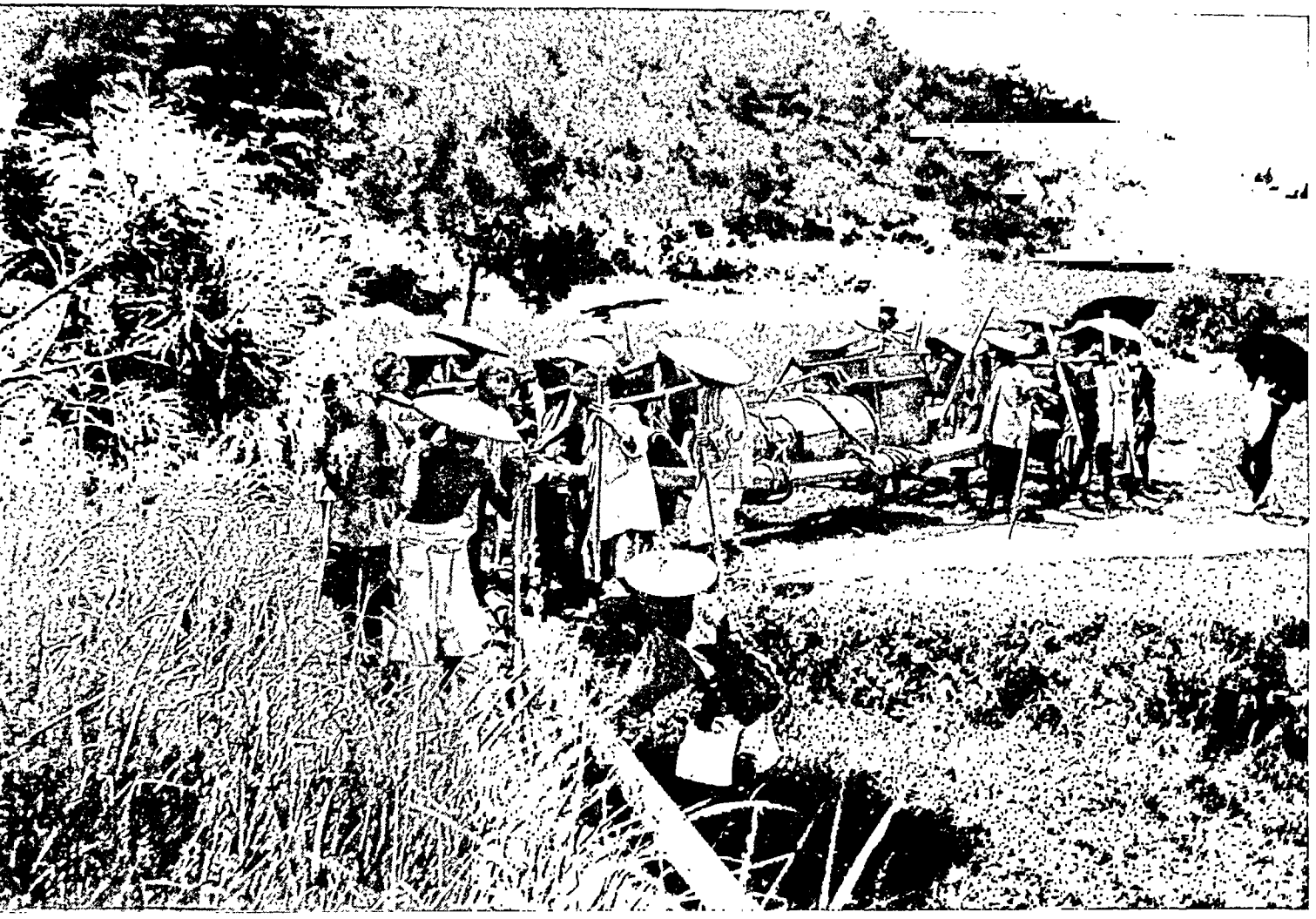
MARSHALL, SONS & CO. LTD.

Engineers

99 CLIVE STREET AND 25 STRAND, **CALCUTTA**

AND

8 HUMMUM STREET, **BOMBAY**



Head Office and Factory:—

BRITANNIA IRON WORKS, **GAINSBOROUGH**

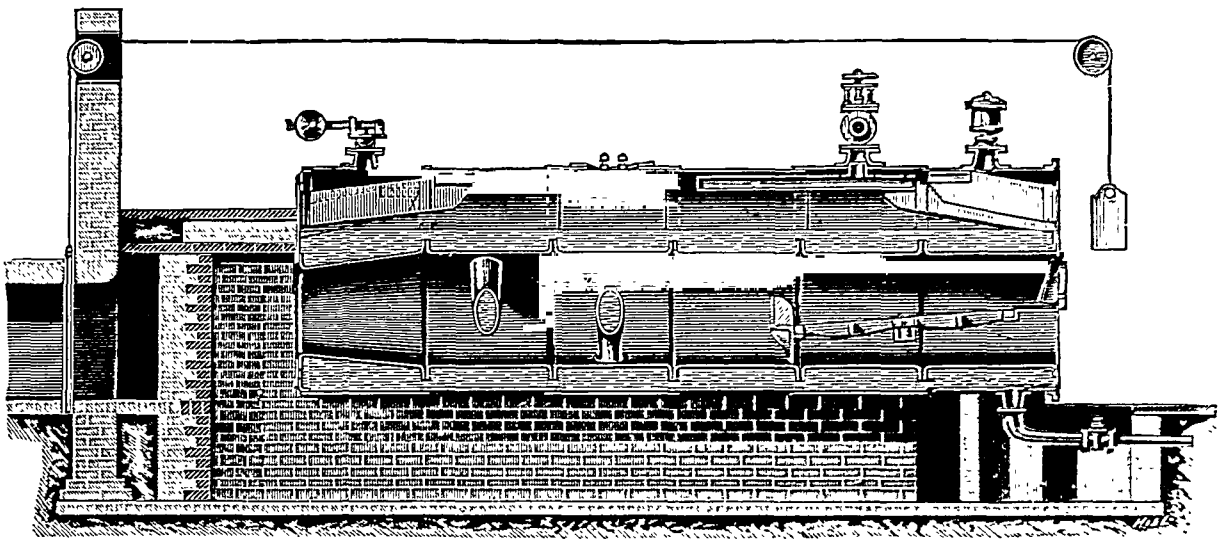
ENGLAND

London Offices, Showrooms and Stores:—

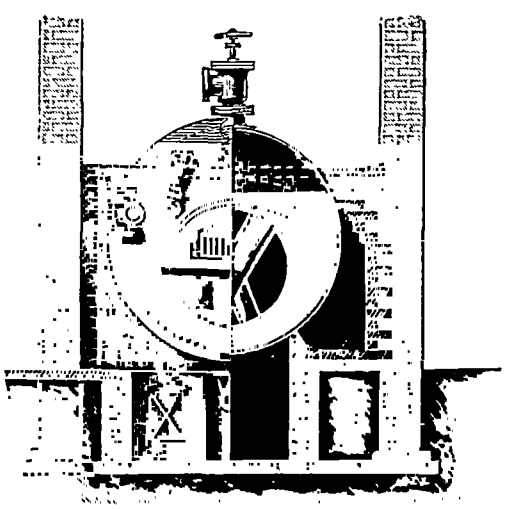
MARSHALLS' BUILDINGS, 79 FARRINGDON ROAD, E.C.

JOHN BELLOWS, GLOUCESTER S220273

"CORNISH" AND "LANCASHIRE" BOILERS



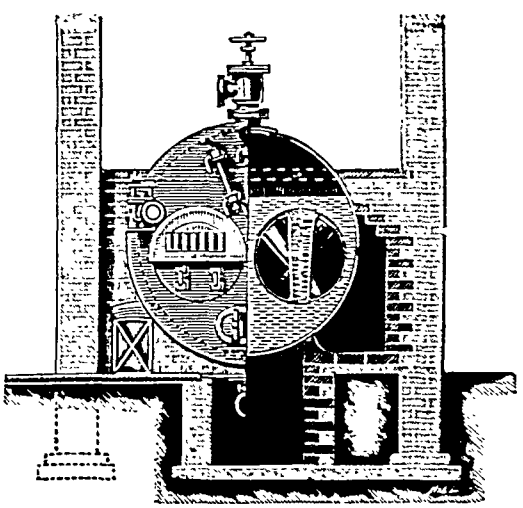
LONGITUDINAL SECTION



END ELEVATION AND SECTION

"CORNISH" BOILER

WITH ONE FLUE



END ELEVATION AND SECTION

"LANCASHIRE" BOILER

WITH TWO FLUES

THESE ILLUSTRATIONS REPRESENT THE BOILERS SET IN BRICKWORK

BOILERS

Cornish Boilers, with one internal circular flue, up to 25 horse-power, and Lancashire Boilers, with two internal circular flues for the larger powers, as shown on previous page, are extensively used where fuel can be obtained at moderate cost, and the necessary brickwork setting and chimney stack can be readily provided. As we make boilers of this class to standard dimensions, we give sizes in table below.

Particulars of our Standard Sizes of Cornish and Lancashire Boilers.

Length	Diameter	FLUES		CROSS TUBES		WEIGHT OF BOILERS For 100 lbs. pressure	
		No.	Diameter	No.		Boiler	Smalls

For many years we have done a very large trade in Steam Boilers, apart from such as are required in connection with our own Engines, but although we have had a very large and complete Boiler Making Plant, our Engineering Department has increased to such an extent during the past few years, that we have experienced considerable difficulty in keeping pace with our own requirements in Boilers, and have been reluctantly compelled to decline large numbers of orders for extraneous Boiler work.

During the past three years we have been engaged in building another large Boiler Shop, and are sparing no expense in fitting it with all the most modern and up-to-date machinery, and when this is completed we shall have THE LARGEST AND MOST COMPLETE PLANT IN THIS COUNTRY *for the manufacture of our class of Boilers, and shall again be in a position to execute extensive orders for high class work in this Branch at reasonable rates.*

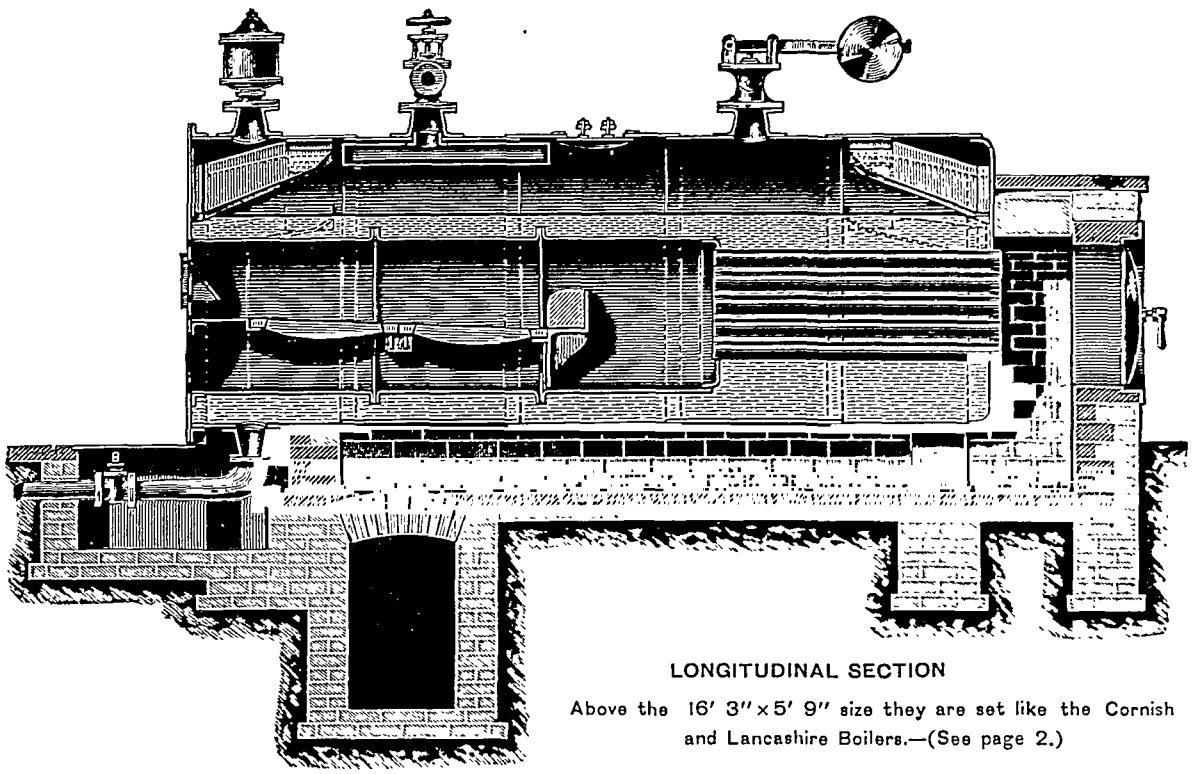
MARSHALL, SONS & CO. LIMITED

GAINSBOROUGH
August, 1902

229273

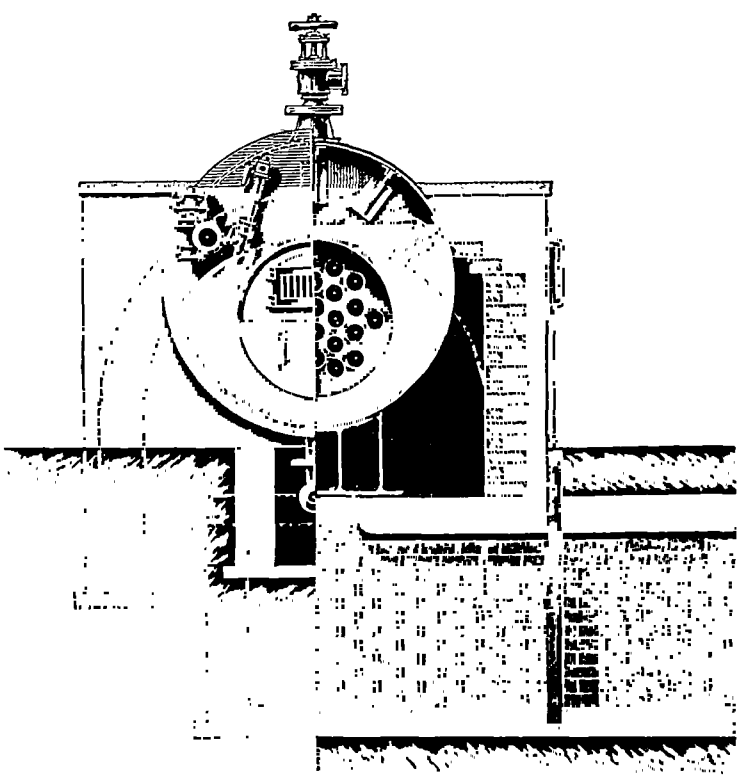
CORNISH MULTITUBULAR BOILERS

(INTERNALLY FIRED)



LONGITUDINAL SECTION

Above the 16′ 3″ × 5′ 9″ size they are set like the Cornish and Lancashire Boilers.—(See page 2.)



END ELEVATION AND SECTION

SHOWING

SIDE FLUE TO BRICK

CHIMNEY

CORNISH MULTITUBULAR BOILERS

(INTERNALLY FIRED)

We supply a large number of these Boilers in connection with our Fixed Engines destined to work in localities where fuel is expensive. They effect a saving of nearly 15 per cent. in fuel compared with the best Cornish or Lancashire Boilers, and, as will be seen from the illustration on the opposite page, the brickwork setting for the smaller sizes is of a more simple character than is required for Boilers of the Cornish or Lancashire types. Further, owing to the large amount of heating surface in the tubes, the external dimensions of these Boilers need not be so large as the Cornish and Lancashire; they are consequently less bulky and heavy, which is a matter of great importance where freight and transport have to be considered.

The Shells are made of Siemens-Martin Steel throughout, of ample strength for working at 100 lbs. pressure; the Flue and Combustion Chamber of Steel, with best high pressure lap-welded Iron Tubes at the back end from 3″ to 4″ diameter, according to size.

The fittings are similar to those supplied with our Cornish Boilers, as enumerated on page 3.

We also supply these Boilers specially constructed to work at 140 lbs. pressure when required, and for the higher pressures and large sizes we can put in a ribbed or corrugated Furnace as shown in the illustration on page 6. Full specifications with prices on application.

CYLINDRICAL MULTITUBULAR BOILERS

(EXTERNALLY FIRED)

These Boilers are in favour in some countries, as they are capable of rapidly generating a large amount of steam compared with the space they occupy, and they are also very economical in fuel. They are well adapted for export on account of their small size and weight, and the furnace can be so arranged as to burn the refuse from Coffee and Sugar Plantations, or in fact almost any description of fuel.

We can, however, only recommend them where the feed water is good, or unless great care is taken to prevent any accumulation of deposit on the bottom of the Boiler over the fire. Full specifications with prices on application.

WROUGHT IRON CHIMNEYS

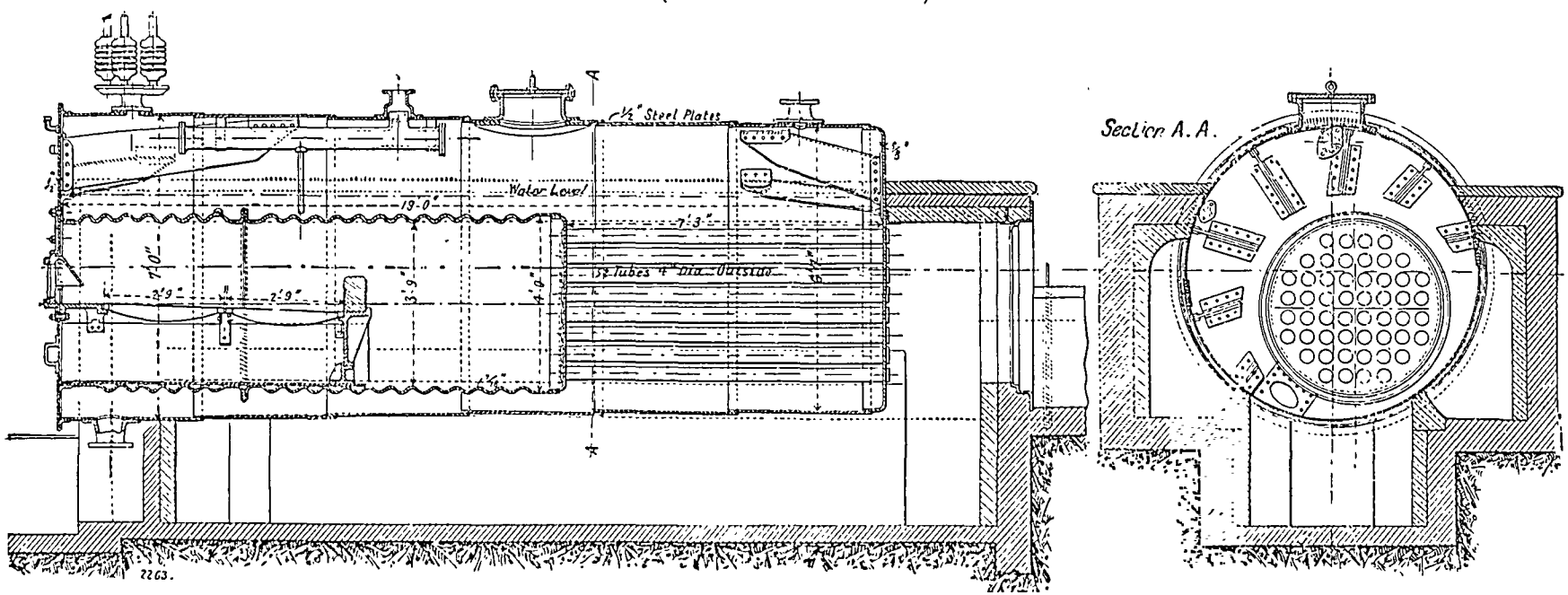
We supply many of these for export, made of strong plates with or without a Cast-Iron Base Plate and guy ropes. They are well adapted for situations where it is not convenient to build a brick shaft, and are sent out in lengths nested one within the other to save freight, and can be readily put together at destination.

Full Particulars and Prices on application.

HIGH-PRESSURE

CORNISH MULTITUBULAR BOILERS

(INTERNALLY FIRED)



The sectional illustration shown above represents one of a series of Cornish Multitubular Boilers supplied by us for the Offices of the "Daily Telegraph," London. The Boiler in question is 19 feet long by 7 feet diameter at the front end, the rings of the shell are placed telescopically so that at the rear end the diameter of the shell is 6 feet 7 ins.; as will be seen from the end view, the furnace is placed on one side of the centre line, this arrangement giving readier access to the lower part of the Boiler for cleaning, &c. The Boiler is set with side flues like an ordinary Lancashire Boiler, the gases after leaving the tubes pass first under the Boiler and then dividing and traversing the side flues to the Chimney.

The larger sizes of Boilers when working at higher pressures can be made with a ribbed or corrugated flue as shown above, but the smaller sizes have flue plates welded and flanged in sections.

EVAPORATION AND FUEL TEST
OF A
CORNISH MULTITUBULAR BOILER

19′ 0″ LONG × 7′ 0″ DIAM. AT FRONT END, AND 6′ 7″ AT BACK END

(Reprinted from "Engineering")

HEATING SURFACE—

Heating surface of Boiler alone ...	804 sq. ft.
No economiser	

FIREGRATE—

Dimensions of firegrate ...	3 ft. 7½ in. × 5 ft. 6 in
Area of grate	20 sq. ft.

PRINCIPAL OBSERVATIONS

TIME—

Duration	7 hours

STEAM PRESSURE—

Mean steam pressure above atmosphere	74·0 lb.
" absolute steam pressure	88·7 "
Temperature corresponding to this pressure	319·3 deg. Fahr.

FEED WATER—

Temperature of feed	47·5 deg. Fahr.
" " after passing feed heater	163 "
Total feed water evaporated	28,141 lb
" " " per hour	4,020 "

COAL AND ASHES—

Total coal put on grate	3084 lb.
" drawn	76 "
" used, including ashes and clinker	3008 "
Per cent. of ash and clinker in total coal used	1·8 and 1·3
" moisture in fuel	1·15
Total weight of pure and dry coal used per hour	412 lb.
Ratio of total pure and dry coal to coal including ash, &c.	0·957
Total coal used, including ash and clinker, per hour	429·6 lb.
" weight of ash and clinker	54·5 lb. ash, 40·5 lb. clinker.

STOKING—

Thickness of fires	3 in. to 4 in.
Number of times each fire stoked per hour	6

TEMPERATURE OF AIR—

Temperature of air in boiler-house	86·4 deg. Fahr.
" outside house	47·0 "

TEMPERATURE OF GASES—

Temperature of furnace gases at base of chimney	732 deg. Fahr.

DRAUGHT—

Chimney draught, inches of water	0·75 in.

PRINCIPAL RESULTS

COMBUSTION—

Pounds of coal burnt per square foot of grate surface per hour	21·5 lb.
" " " " heating " "	0·534 "

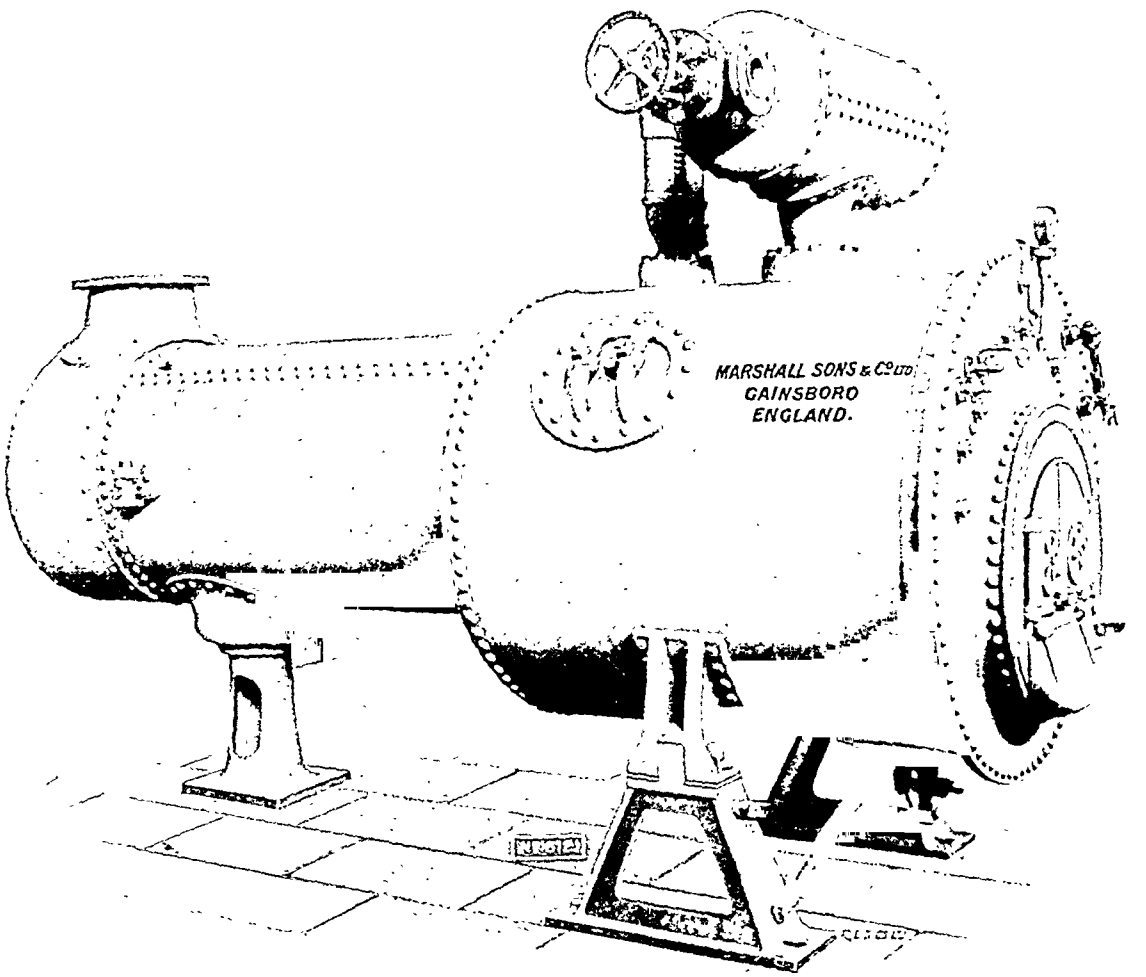
EVAPORATION—

Pounds of water evaporated per pound of coal from feed temperature	9·36 lb.
Equivalent evaporation per pound of coal from and at 212 deg. Fahr.	10·15 "
Equivalent evaporation per pound of coal pure and dry	10·60 "
" " square foot of grate per hour	217·5 "
" " " heating surface	5·42 "
Factor of evaporation	1·084

The above is an extract from one of the tests conducted at the printing office of the DAILY TELEGRAPH, Fleet Street, London, the experiments being made on one of the Boilers supplied by us at that Establishment. The tests were made by Mr BRYAN DONKIN and Professor A. B. W. KENNEDY, F.R.S., without our knowledge or assistance, and the stoking was done by hand by the usual stoker, the ordinary Welsh Coal supplied at the time to the Boiler house being burnt. A much smaller Boiler of the same type, which, at the date of the trial, had been in use nearly six years at the printing office of ENGINEERING, was also tested in 1888, by the same high authorities, and the results closely approximated to those above given.

MARSHALLS'

"BRITANNIA" BOILER



These Boilers are suitable for supplying steam to separate Fixed and other Engines, and they embody many of the advantages of our Cornish Multitubular Boilers, without requiring any brickwork setting. Owing to the circular form of the outer shell, and the absence of stays between the shell and fire-box, they are more suitable than the ordinary Loco. Boilers for working with bad feed water.

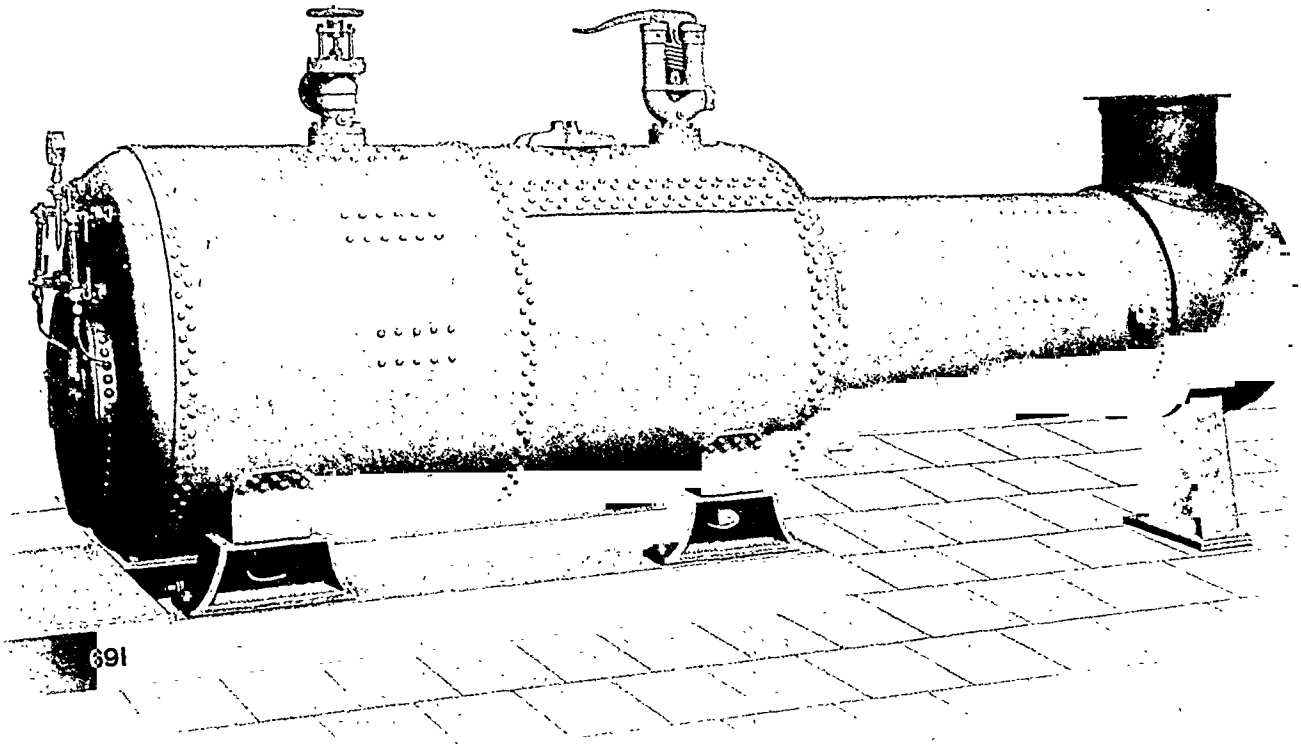
This type of Boiler is made in 12 sizes from 4 to 30 H.P. inclusive, suitable for **100 lbs.** pressure.

We recommend a Horizontal Steam Drum, as shown above, and this is bolted to a steel fixing on the top of the Boiler, so that it can readily be detached for shipment. We include this Steam Drum with Boilers of 10 H.P. and upwards, but it is charged extra in connection with the smaller sizes.

Prices and full Particulars on Application.

MARSHALLS'

SPECIAL "DREDGER" BOILER



We have given the matter of Boilers our most careful consideration, and the above represents a type of Boiler specially designed for use on Gold Dredges, but they can also be used with advantage for other classes of work. We construct them of Steel of ample strength for **140 lbs.** working pressure, and make them in various sizes from 14 to 30 N.H.P. The boiler is circular throughout, and therefore stays between the inner and outer fire-box are not required, thus making it more easy to clean and consequently less liable to deteriorate with bad feed water than the ordinary boiler of the locomotive type. We think our dredging friends will fully appreciate the advantages of a boiler made to our design, as the water available is frequently not of the best. These boilers can also be fired with rough wood logs as fuel. The fire-box is specially proportioned to meet all requirements as to inferior fuel, and this Boiler has given unqualified satisfaction in this respect in all parts of the world.

Our "Dredger" type Boilers can be easily mounted on board the dredges, or put down on an ordinary floor, and they are supplied with a full set of first-class fittings and mountings.

Prices and full Particulars on Application

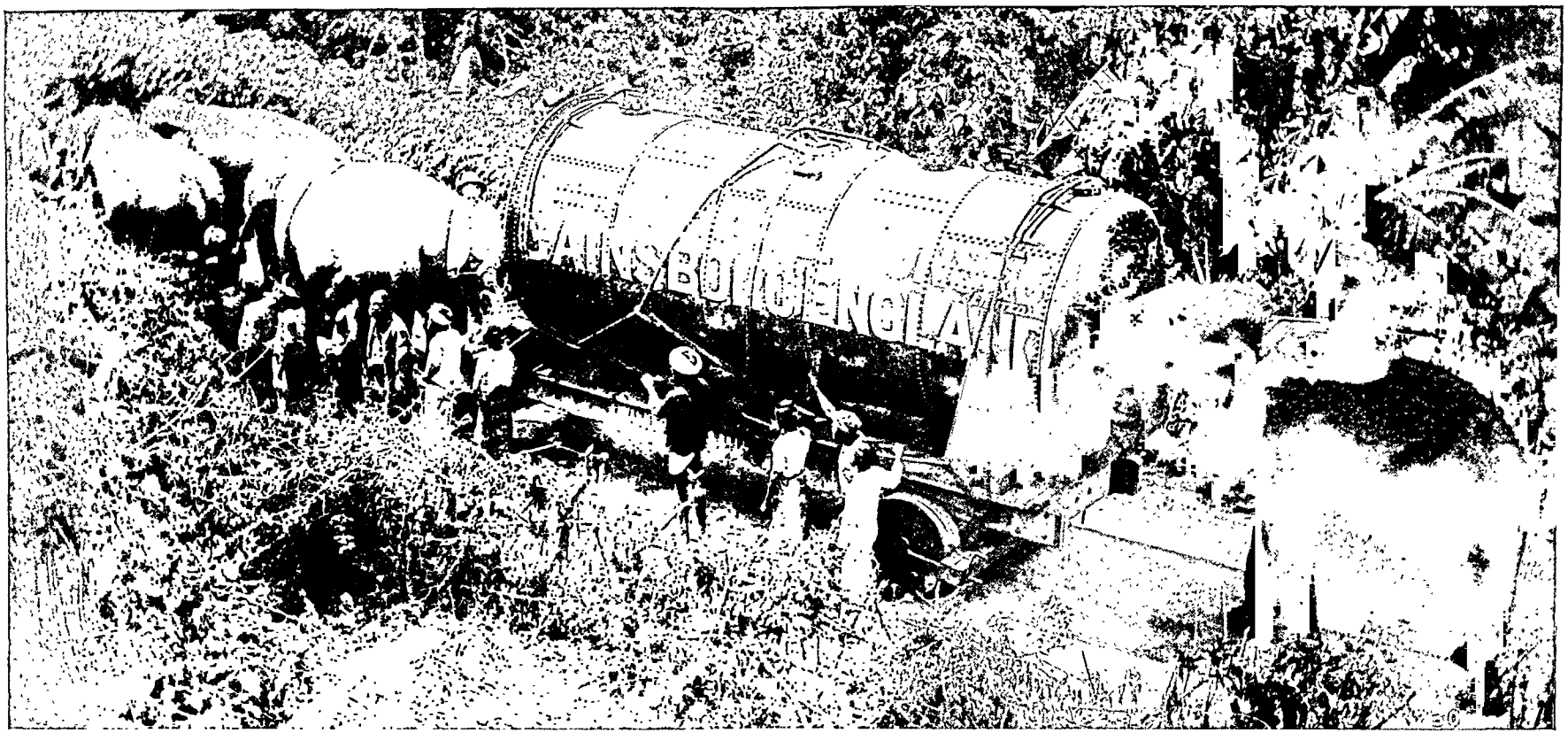
TRANSPORT DIFFICULTIES IN FOREIGN COUNTRIES

The Illustrations on pages 1, 10 and 11, taken from photographs, convey some idea of the difficulties which attend the transportation of Machinery and similar heavy goods in countries where the roads are not of the best, where railways do not exist, and where recourse must be had to native labour, and to draught animals.

ABOUT TO START FOR A CEYLON TEA ESTATE

The Illustration on front page is taken from a photograph of a view in China, and shows one of our Portable Engines, which has been dismounted and stripped, the Boiler being carried bodily into the interior of the country by coolies.

The Illustrations on pages 10 and 11, show a large Cornish Multitubular Boiler, being transported by our Colombo Representatives to one of the Tea Gardens in Ceylon, and the view on page 11 is particularly interesting as showing how a stiff bit of road through the jungle had to be negotiated.

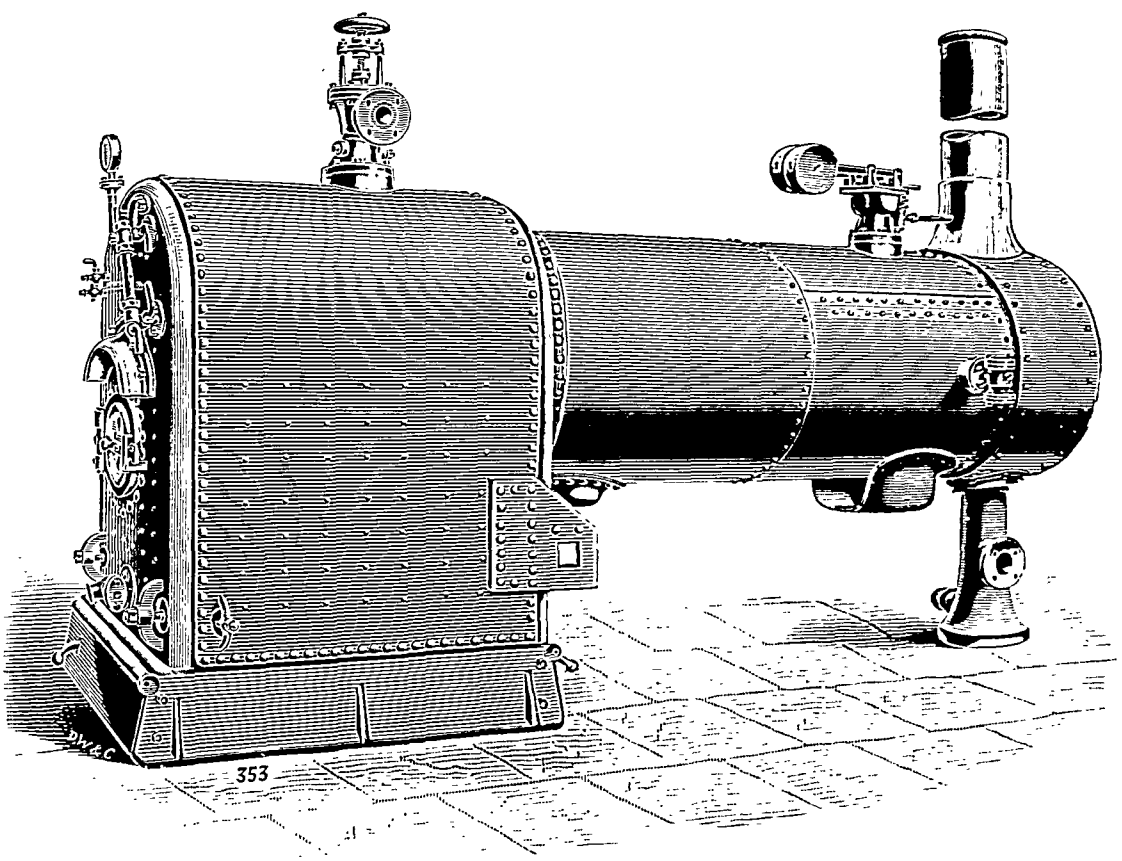


ON THE ROAD TO A CEYLON TEA ESTATE

At our Depôts in Calcutta, Bombay, etc., we keep an assortment of strong wrought-iron travelling wheels and axles of various sizes, suitable for carrying heavy Boilers, cases of Machinery, etc., and these can be let out temporarily to our Customers for their convenience in getting their goods to destination.

LOCOMOTIVE MULTITUBULAR BOILER

AS MADE FROM 2 TO 12 H.P. INCLUSIVE



For many years we have made the manufacture of Loco. Boilers a speciality, and we have one of the largest and most complete plants in this country for their production, replete with all the most modern machine tools and appliances for turning out the best possible work in this branch.

The use of Loco. Boilers has largely extended during the last few years, as they are self-contained, easy of erection, very economical in fuel, and being supported on a strong cast-iron ash-pan at the fire-box end, and a substantial pedestal under the smoke-box, only *very little brickwork is necessary.*

The Illustrations on this and the following page represent our standard types of Loco. Boilers, as constructed for **100 lbs.** working pressure. The shell-plates are made of Siemens-Martin Steel, and the internal fire-box of Steel or best Yorkshire Iron. The longitudinal seams in the barrel are double rivetted, the edges of the plates are planed, and the rivetting and flanging done by special machinery.

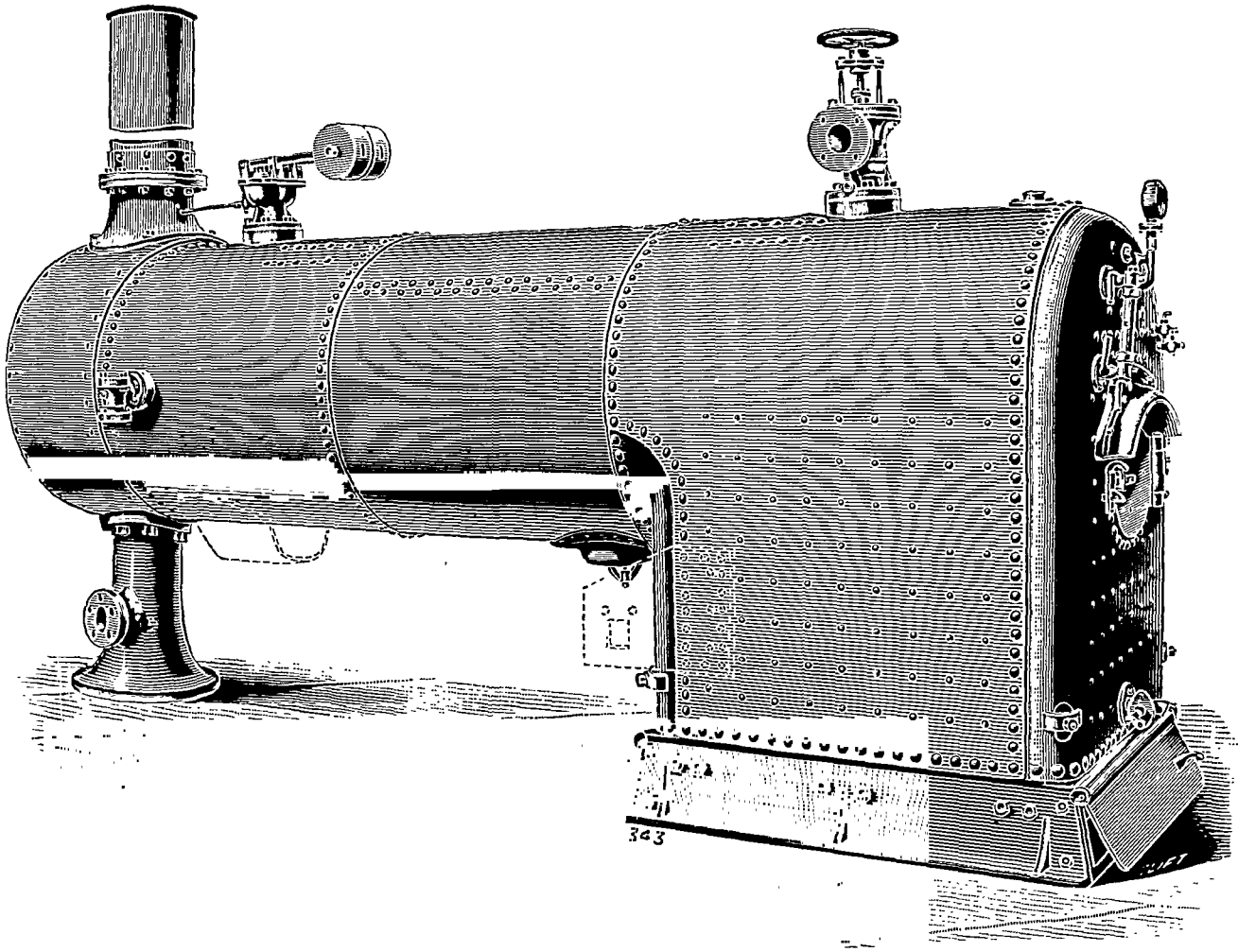
The **Fire-box** is of large size, suitable for burning coal or good wood; but where wood refuse and inferior fuel are used we recommend our extra long or Colonial-sized Fire-box, which can be supplied at a slight extra cost. We give ample water space between the fire-box and the shell, and in Boilers of 14 H.P. and upwards we use solid foundation rings.

(CONTINUED ON NEXT PAGE)

LOCOMOTIVE MULTITUBULAR BOILER

FLUSH TOP TYPE

AS MADE FROM 14 H.P. UPWARDS



(*CONTINUED FROM PREVIOUS PAGE*)

The **Man Hole** is placed in such a position as to give ready access to the top of the Fire-box, and the Mud-holes are so arranged that all sides of the Fire-box can readily be got at for cleaning.

Fittings :—Each Boiler is provided with a complete set as shown, including stop and safety valves, steam and water gauges, blow-off cock and feed check valve. The stop and safety valves are bolted to separate wrought-iron blocks strongly rivetted to the Boiler Shell, and as these blocks are of the same size the positions of these two valves can be changed to suit circumstances.

Lagging :—In Boilers up to 12 H.P. the barrel only, and from 14 H.P. upwards the barrel and upper part of the fire-box can be lagged with wood and covered with sheet iron, as shown on page 15, at a slight extra cost, or we can supply the Boilers with suitable irons to receive non-conducting composition and a sufficient quantity of the latter to cover the whole of the Boiler. We recommend this especially in the larger sizes.

These Boilers can, when required, be supplied with axle lugs and turn plate, as shown in dotted lines above, and on page 14, for the application of travelling wheels and undergear to facilitate transport.

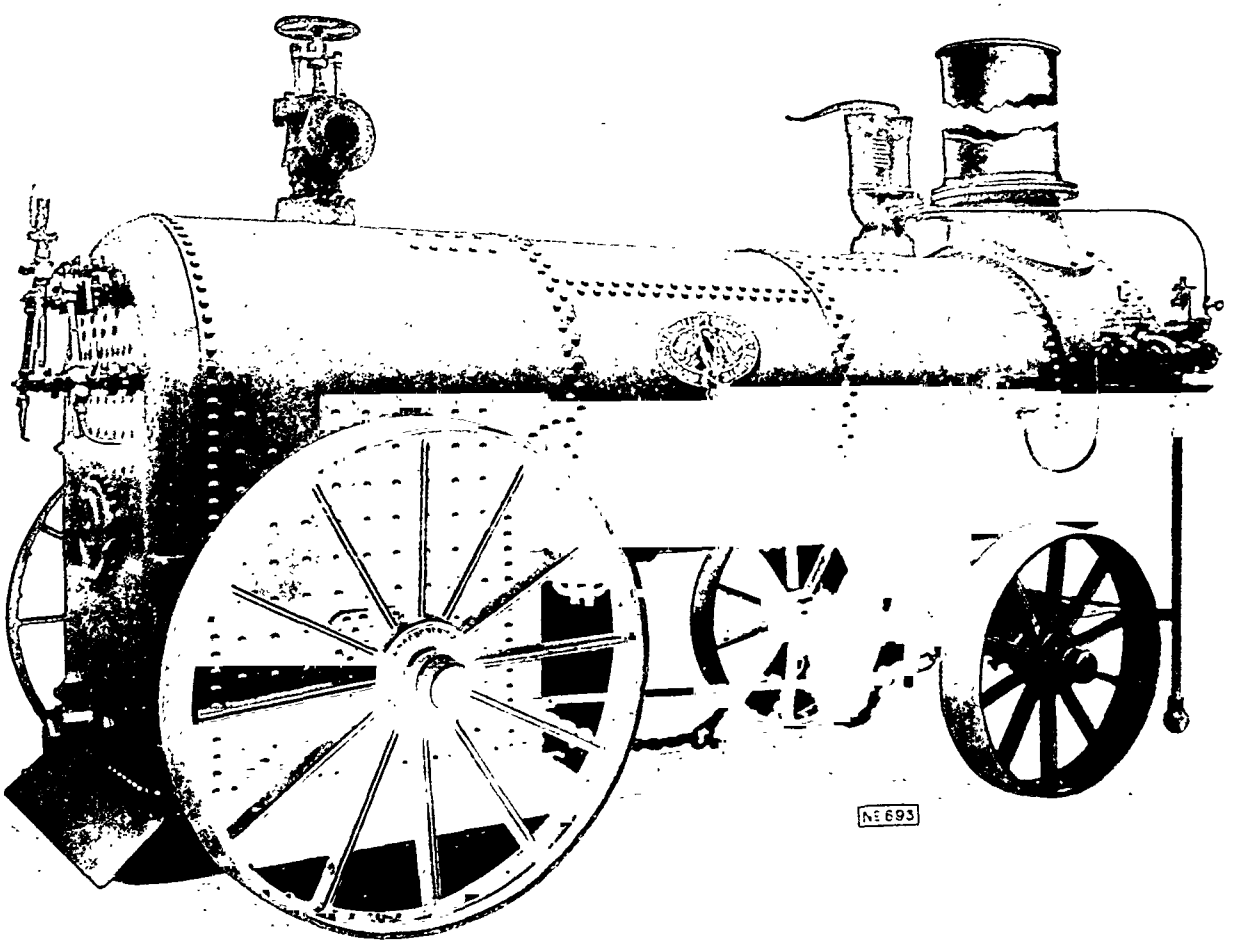
Prices and full particulars on application.

PORTABLE
LOCOMOTIVE MULTITUBULAR BOILER

FLUSH TOP TYPE

AS MADE FROM 14 H.P. UPWARDS

(Illustration from Photograph of 25 H.P. Size.)



This illustration represents our Standard Type of **Portable Locomotive** Boilers for **100 lbs.** working pressure. They are very convenient for temporary work, being entirely self-contained, and they can readily be moved from place to place.

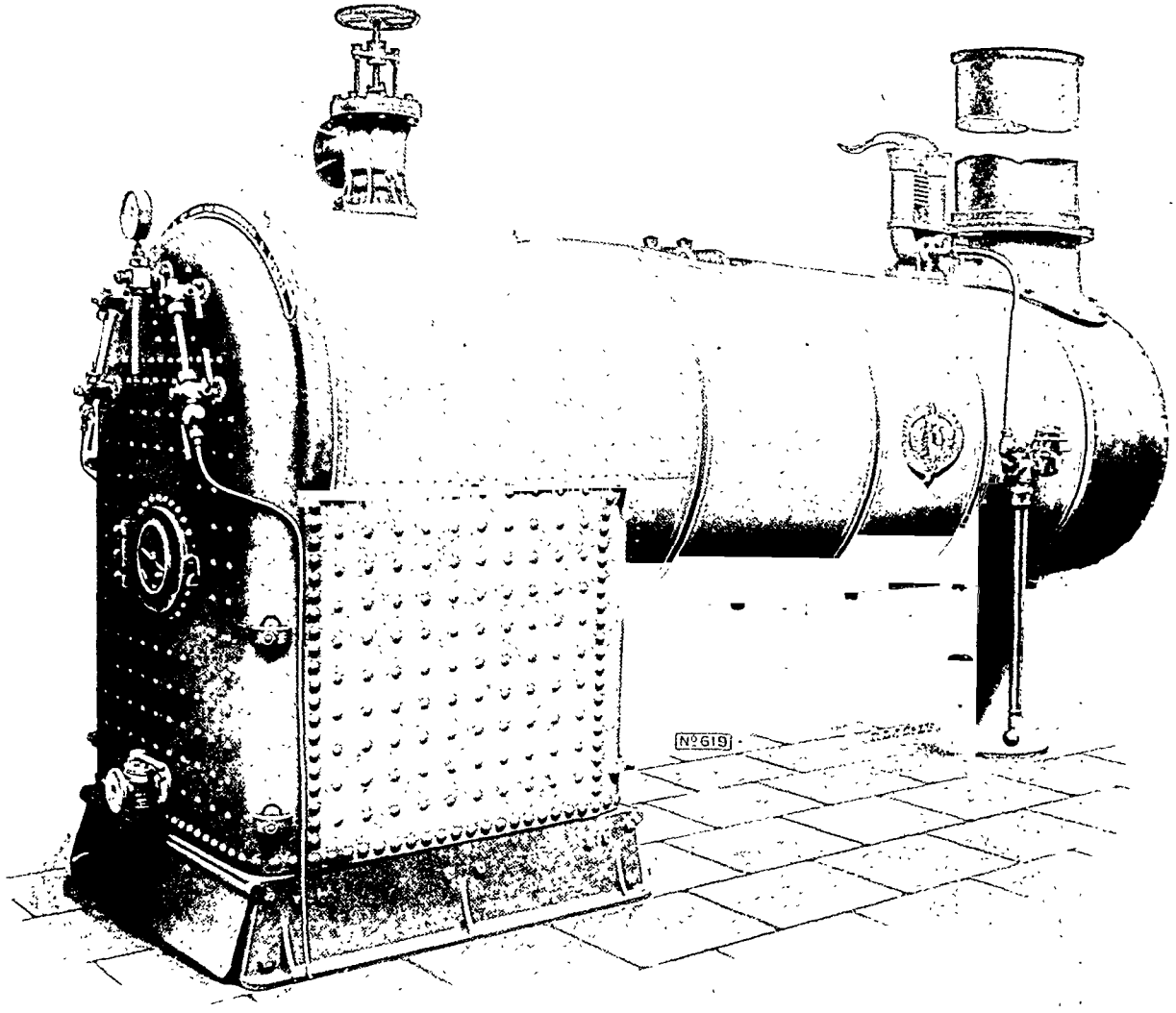
These Portable Boilers are provided with an efficient donkey feed pump, as shown above, and also with a suitable length of W.I. chimney, and they are mounted on strong wrought-iron travelling wheels, with steel plate fore-carriage, which are practically indestructible.

Full Particulars, with Prices for Sale or Hire, on Application

HIGH-PRESSURE

LOCOMOTIVE MULTITUBULAR BOILERS

FOR COMPOUND ENGINES



The above illustration represents one of our **Locomotive Multitubular Boilers,** made throughout of extra strength for working at **150 lbs.** pressure to supply steam to our **Compound Engines.** The Shell Plates are of Siemen's Martin Mild Steel, of special quality, and the internal Fire-box is also of Steel, and only the best workmanship is embodied in their construction.

These **Boilers** can be arranged to burn Coal or Coke, or with enlarged Fire-box for burning wood and refuse as fuel, and where it is not convenient to use the ordinary Chimney the smoke can be taken through a downtake under the Smoke-box into an underground flue.

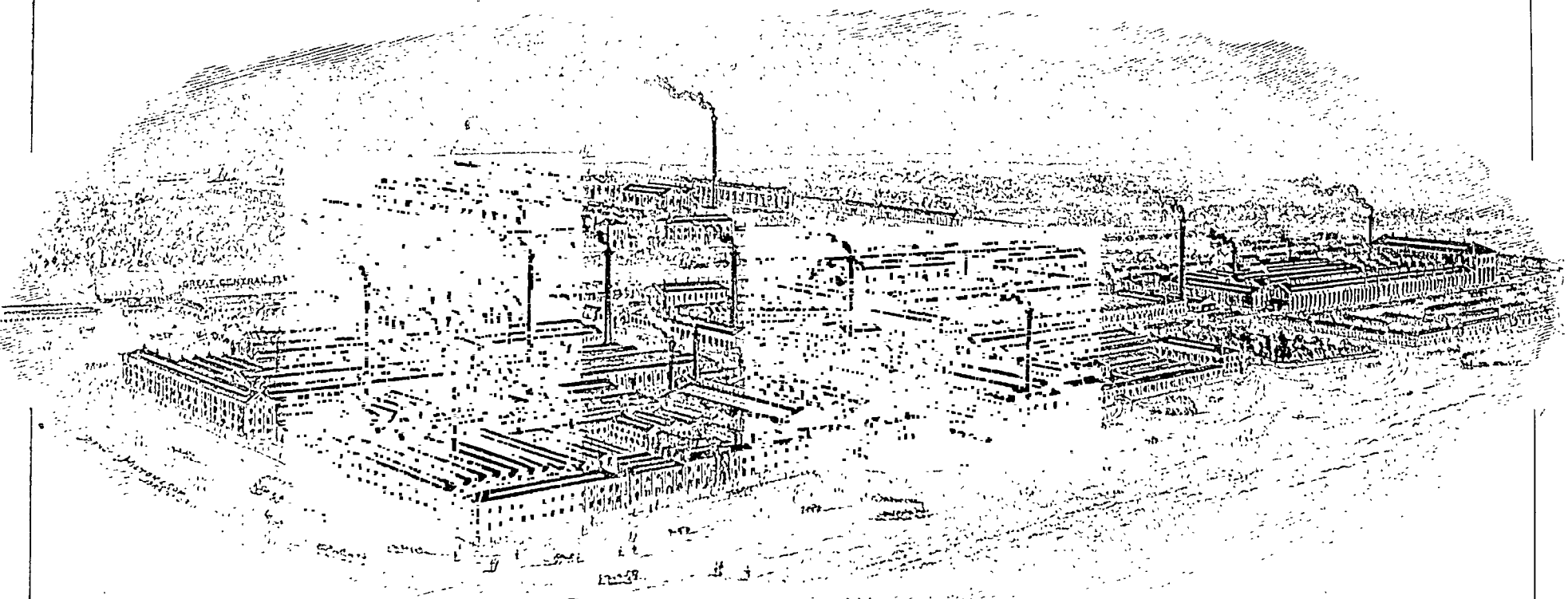
Lagging :—In these high-pressure Boilers this is strongly recommended to prevent radiation and is included in the price. They are either lagged with wood and covered with sheet iron, as shown above, or they can be supplied with suitable irons, for carrying non-conducting composition and a sufficient quantity of the composition to cover the whole of the Boiler at destination, as may be preferred.

Prices and full particulars on application

MARSHALL, SONS & CO., LIMITED

GAINSBOROUGH, LONDON, CALCUTTA, BOMBAY, and DUNEDIN, N.Z.

Area of Works, 28 acres. Employing 3,500 hands. Upwards of 75,000 Engines and Boilers made.
The GRAND PRIX and GOLD MEDAL, Paris, 1900.



BRITANNIA WORKS.

GENERAL ENGINEERS AND MANUFACTURERS of High-Class Horizontal Engines up to 1000 H.P. Vertical Engines with and without Boilers. Undertype Engines, high pressure and compound. Electric Light Engines. Portable and Semi-Portable Engines, Road Rollers and Traction Engines. Thrashing, Grinding and Sawing Machinery. Tea Preparing Machinery, Gold Dredging Machinery, &c.

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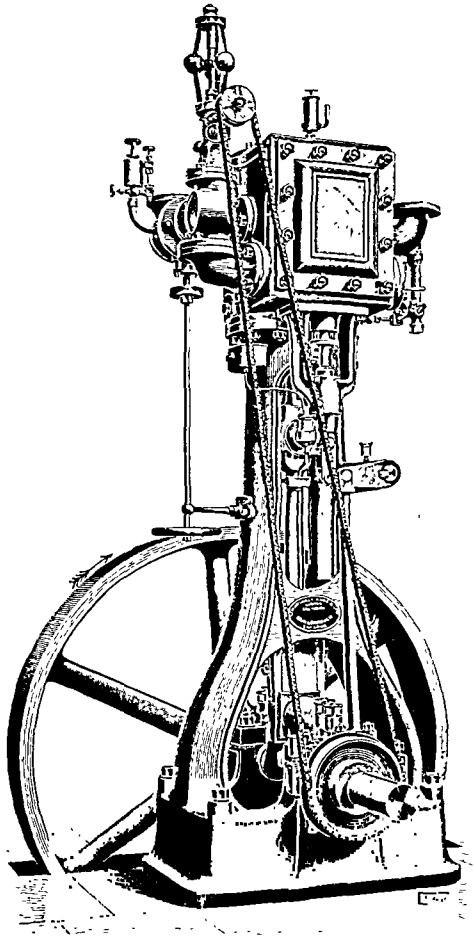

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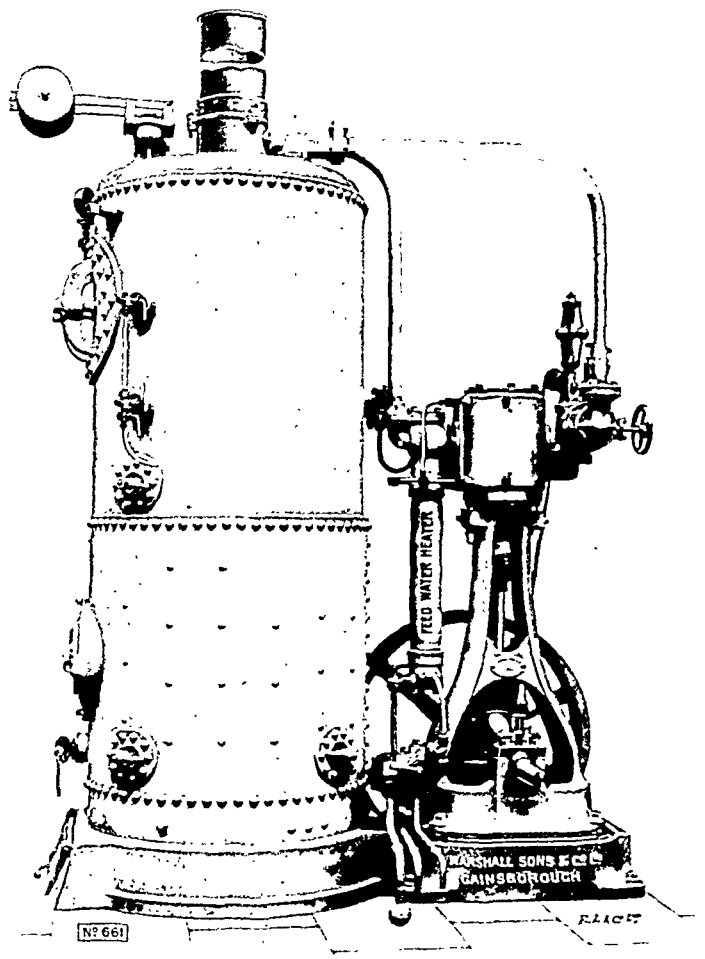
NEW PATTERN VERTICAL

STEAM ENGINE WITH BOILER

OF THE CROSS-TUBE TYPE



Class MP. fitted with PICKERING Sensitive Governor and Equilibrium Throttle Valve. This Governor is driven by a link leather belt from the Crank-shaft, and is supplied with a separate spring adjustment for varying the speed whilst the Engine is in motion. See also illustrations on pages 6 and 7.

Class M. fitted with the MOORE Patent Crank-shaft Governor, and Automatic Cut-off Balanced Slide Valve. See page 8.

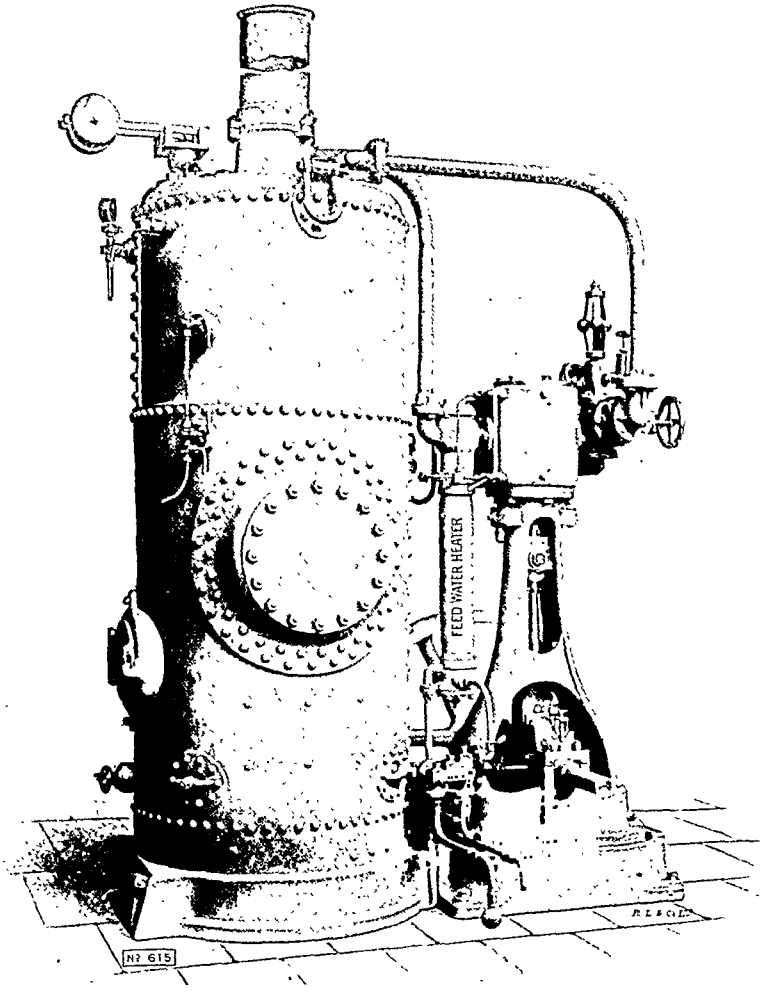
Above Illustration is from a Photograph of a Class MP. Vertical Engine with Cross Tube Vertical Boiler and Feed Water Heater.

For sectional illustration of this type of Boiler, see page 16.

NEW PATTERN VERTICAL

STEAM ENGINE WITH BOILER

OF HOPWOOD'S PATENT TUBULAR TYPE



Class MP. fitted with PICKERING Sensitive Governor and Equilibrium Throttle Valve. This Governor is driven by a link leather belt from the Crank-shaft, and is supplied with a separate spring adjustment for varying the speed whilst the Engine is in motion. See also illustrations on pages 6 and 7.

Class M. fitted with the MOORE Patent Crank-shaft Governor, and Automatic Cut-off Balanced Slide Valve. See page 8.

Above illustration is from a Photograph of a Class MP. Vertical Engine with Hopwood's Patent Tubular Vertical Boiler and Feed Water Heater.

For sectional illustration of this type of Boiler, see page 17.

HIGH-CLASS VERTICAL ENGINES

TYPES MP. and M.

These Engines are intended to supersede those described in our previous Catalogues, and have been specially designed to utilize to the best advantage the higher pressures of steam now largely used in Boilers of all kinds—and for this purpose they are constructed throughout of ample strength to work with steam up to **100 lbs.** pressure, if required. They are self-contained, massive in design, of the best materials and workmanship in every detail, and are much superior to the usual class of Vertical Engines.

We have now supplied a very large number of these **Classes MP.** and **M.** Engines which are giving the utmost satisfaction in every respect, and we make them with Cylinders from $4\frac{1}{2}$ in. to 16 in. diameter, inclusive.

The **Standard** on which the Engine is erected sustains the entire working strain, the upper part being bored to form sliding surfaces of large area for the crosshead.

The **Cylinder** is of Cold Blast Iron, the outer casing being well Felted and covered with a Steel Plate. A PATENT AUTOMATIC SIGHT-FEED LUBRICATOR, and the necessary Drain Cocks are also provided.

The **Slide Valve** is of the same class of iron as the Cylinder to ensure uniformity of wear, and both **Slide, Stop** and **Throttle Valves** are readily accessible.

The **Crank-Shaft** is of **Steel,** bent from a single bar without welding, and of sufficient length to receive a pulley on the opposite end to the fly-wheel, thus enabling the power to be given off on either or both sides of the Engine at once.

If **two Driving-wheels** are required, we strongly recommend that these be both put on the same side of the Engine and the shaft extended, with a neck on for the outer bearing; this can be done at a slight extra charge. A driving-wheel on each side of the Engine makes it inaccessible to the attendant for cleaning purposes.

NOTE.—The Governor in connection with the Class M. Engines and Eccentrics in MP. Engines of 12 in. and upwards are placed outside the Engine Frame at the end of the Crank-shaft opposite the fly-wheel as shown on pages 7 and 8, thus there is only room on the outer end of the shaft in these larger Engines for a narrow pulley. In Engines of 12 in. cylinder and upwards the Fly-wheel is placed on the opposite side to the Valve-chest; see illustration on page 7.

Variable Expansion Eccentric and Reversing Apparatus.—We apply this valuable adjunct to all our **Class MP.** Engines without extra charge. By means of this Apparatus the admission of steam can be varied from full power down to as low as one-fourth, with proportionate economy in fuel according to the power given off. Only one eccentric and slide valve are used, thus no extra wearing parts are introduced. It also forms a simple Reversing Apparatus, enabling the Engine to be set to run in either direction to suit the machinery to be driven.

The **Fly-wheel** is of ample size and weight, and is turned on its periphery for receiving a driving belt, and can be arranged to run in either direction to suit the work.

Force Pump, *fitted with a hollow plunger and treble valves for continuous working,* is driven by an eccentric from the crank-shaft and attached to the base of the Engine Standard; it is arranged to take the feed-water from an independent water supply, and Engines are supplied with or without this appendage as may be preferred.

The **Boiler** is of large capacity and of sufficient strength for **80 lbs.** working pressure, the vertical seams in shell are **double rivetted,** and the boiler throughout is rivetted together by patent machinery, and has a solid frame at the bottom of the water space and round the firehole. The crown of the fire-box is stayed to the top of the shell as shown in the sectional illustration on page 16.

The **Fire-box** is intersected by cross section or water tubes, has ample grate area, and is provided with large heating surface. The boilers steam well with inferior fuel. A manhole and the requisite mud-holes, fitted with strengthening rings, are provided for thoroughly cleaning the boiler, as also two safety valves, steam pressure gauge, water gauge, blow-off cock, and furnace bars complete, and the base on which the boiler is mounted is arranged to form an ash-pit with a regulator for the draught.

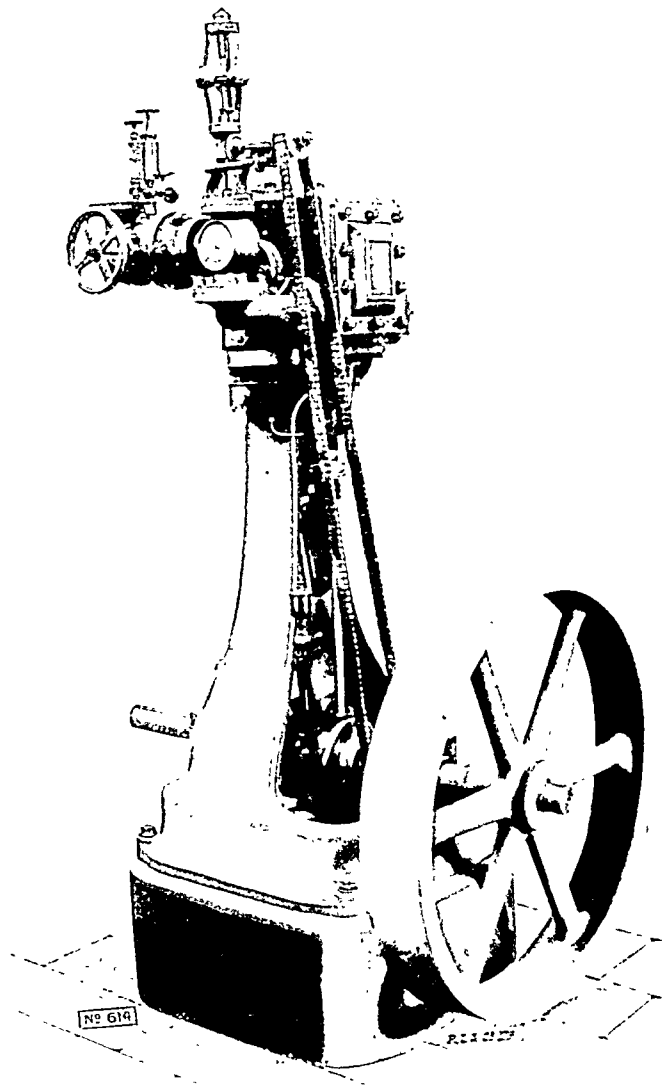
The **Chimney** can be lengthened to pass through the roof of a building, or it can be constructed of cast-iron in an elbow form, to turn into an ordinary brick flue, at a small extra cost.

Every Engine is thoroughly tested under steam prior to leaving the Works, and is provided with a set of case-hardened spanners, firing tools, oil-can, and spare gauge glass. Purchasers can be supplied with duplicate wearing parts, by simply stating the number on the Engine name-plate when ordering, as all our Engines are made to template and gauge throughout.

For promoting **economy in fuel,** we supply in connection with these Engines, when required, an efficient FEED-WATER HEATER of the Vertical type for heating the feed-water to a high temperature on its passage to the boiler, by means of the exhaust steam. This Heater is shown in the illustrations on pages 2 and 3, and the extra cost is given in our price list.

HIGH-CLASS

SELF-CONTAINED VERTICAL ENGINES



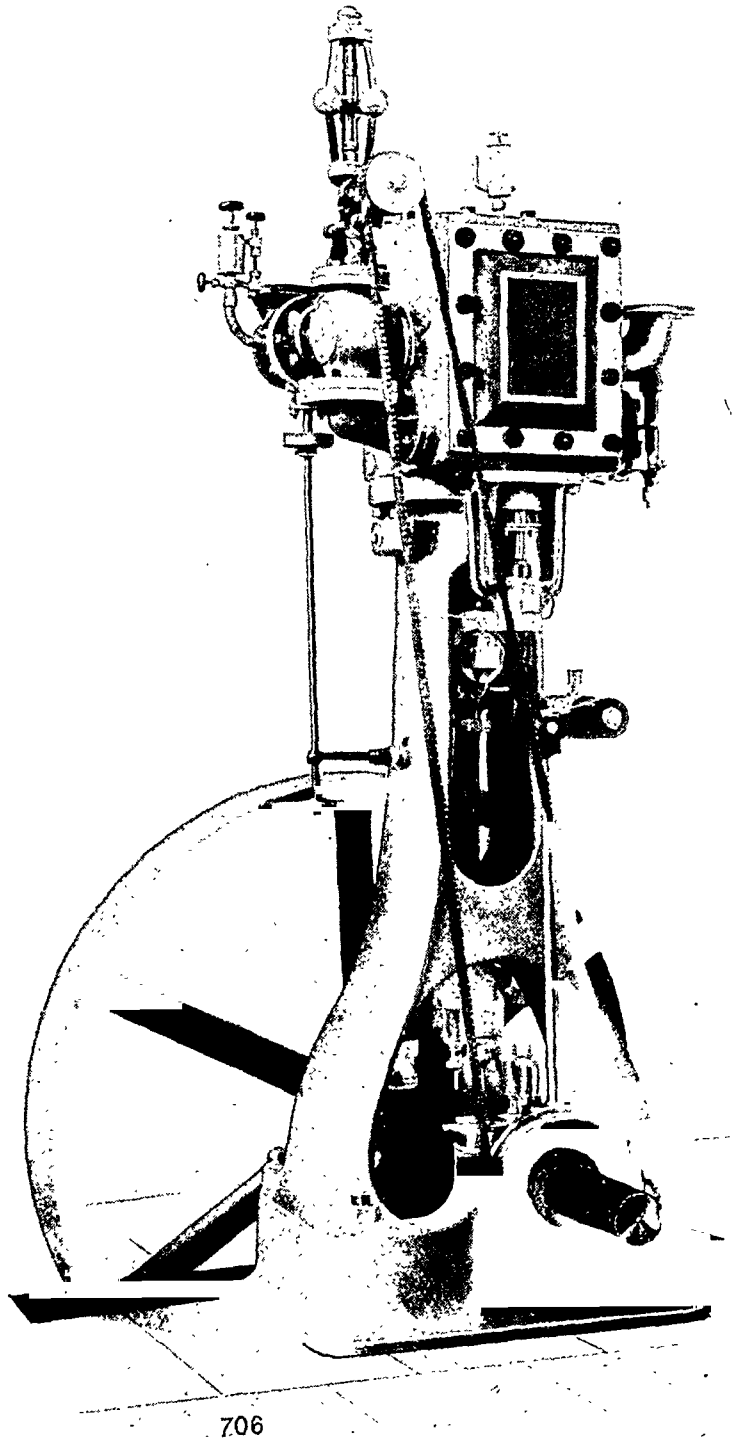
Class MP. As made from 4½ in. to 11 in. cylinder inclusive.

Class MP. fitted with PICKERING Sensitive Governor and Equilibrium Throttle Valve, and speed varying arrangement, as shown above.

Class M. fitted with MOORE'S Patent Crank-shaft Governor and Automatic Cut-off Balanced Slide Valve. See page 8.

We recommend the **Class MP.** Engines for general industrial purposes, but they are also suitable for **Electric Lighting** and similar work requiring great steadiness in running.

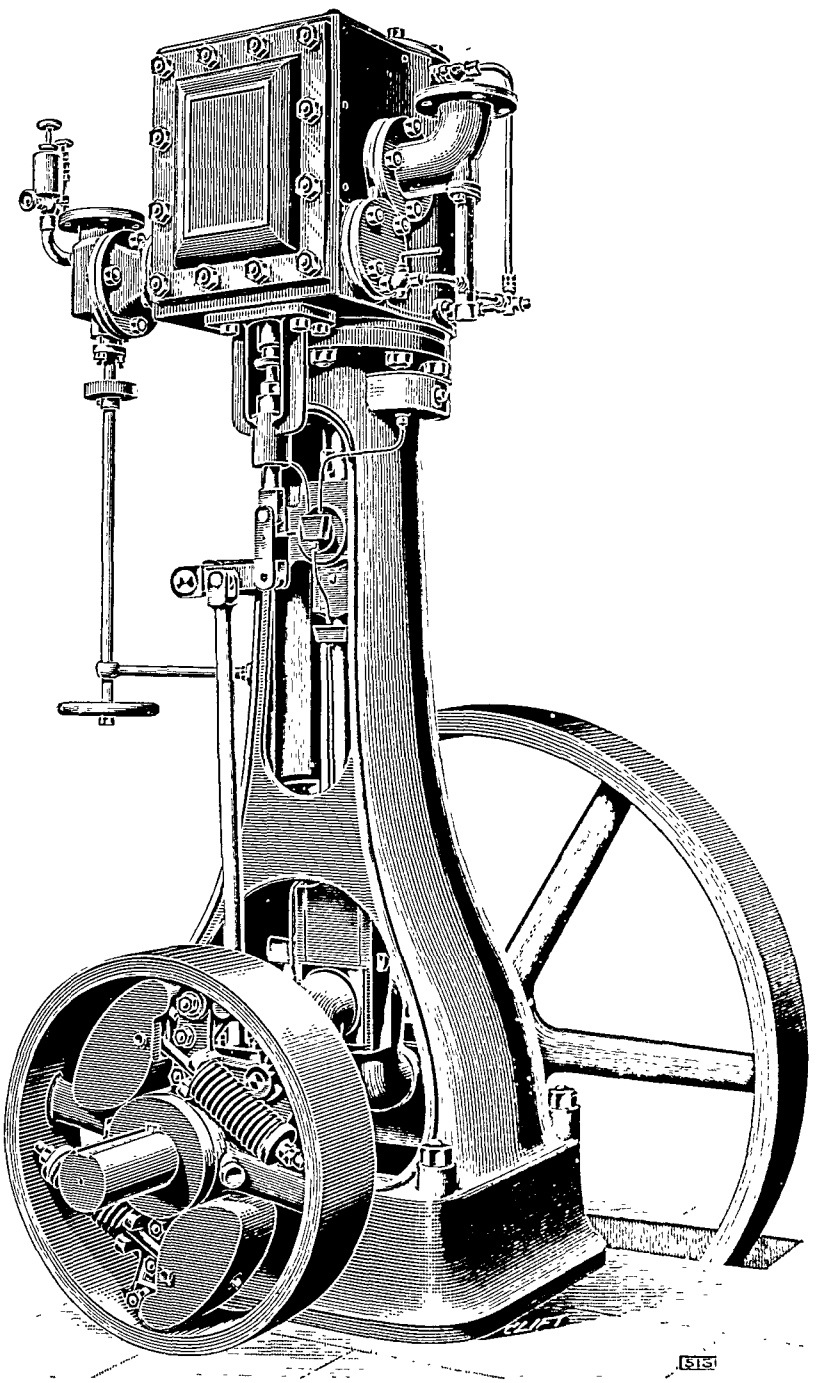
HIGH-CLASS
SELF-CONTAINED VERTICAL ENGINE



Class MP. (as made from 12in. to 16in. cylinder inclusive), fitted with PICKERING Sensitive Governor and Equilibrium Throttle Valve and speed varying arrangement. With the 14½in. and 16in. Engines we include Barring Gear, also a third Bearing and A Standard for the outer end of the crankshaft beyond the fly-wheel.

HIGH-CLASS

SELF-CONTAINED VERTICAL ENGINES



Class M. (as made from 12 in. to 16 in. cylinder inclusive,) fitted with MOORE's Patent Crankshaft Governor, and Automatic Cut-off Balanced Slide Valve.

With the 14½ in. and 16 in. Engines we include Barring Gear, also a third Bearing and A Standard for the outer end of the crankshaft beyond the fly-wheel.

HIGH-CLASS VERTICAL ENGINES

CLASS "MP" AND "M"

As the term "Nominal Horse Power" is apt to be misleading, we have decided not to make use of it in connection with these Engines, and they will be designated by the size of the cylinder. As these new Engines have been specially designed to work at a high pressure, and at a high rate of piston speed, they will consequently give out considerably more power than ordinary Engines with cylinders of the same diameter; therefore, kindly bear this in mind in comparing these Engines with those of other makers. We have given in the table below the effective horse power developed by the different sizes of Engines at 60, 80, and 100 lbs. boiler pressure.

Cylinder Diameter	Cylinder Stroke	Revs. per Minute	Diameter of Fly Wheel	Effective Horse Power at Boiler Pressures of 60 lbs. Economical Load	60 lbs. Maximum Load*	80 lbs. Economical Load	80 lbs. Maximum Load*	100 lbs.† Economical Load	100 lbs.† Maximum Load*
4½"	8"	260	3' 0"	3¼	4½	4½	5½	5	6¼
5½"	8"	260	3' 0"	4½	7¼	6½	9	7½	10
6½"	10"	210	3' 6"	6¾	10	9¼	12	10½	14
7½"	10"	210	3' 6"	9	13	12¼	17	13¾	19
8"	12"	175	4' 6"	10	15	14	19	16	21
9"	12"	175	4' 6"	13	19	17½	24	20	26
10"	14"	150	5' 0"	16	24	22	30	25	33
11"	14"	150	5' 0"	19½	29	26½	36	30½	40
12"	16"	130	6' 0"	23	34	31½	43	36	48
13"	16"	130	6' 0"	27	41	36½	50	42	56
14½"	20"	105	8' 0"	35	53	49	67½	55	75
16"	20"	105	8' 0"	43	65	59½	81½	66	90

The above Table gives the speeds, &c., we recommend for **ELECTRIC LIGHT** and other quick running Machinery, but for general industrial purposes a somewhat slower speed is usually preferred. With the smaller number of revolutions the Engines will, of course, not develop so high an effective Horse Power, as will be seen from the table below. The Class M Engines should always be run at the higher speed.

4½"	8"	190	3' 0"	2¼	3¼	3¼	4	3½	4½
5½"	8"	190	3' 0"	3¼	5¼	4½	6½	5½	7¼
6½"	10"	168	3' 6"	5¼	8	7¼	10	8½	11
7½"	10"	168	3' 6"	7¼	10	9½	13½	11	15
8"	12"	140	4' 6"	8	12	11	15	12½	16½
9"	12"	140	4' 6"	10¼	15	14	19	16	21½
10"	14"	120	5' 0"	12½	19	17½	24	20	26¼
11"	14"	120	5' 0"	15½	23	21	28½	24¼	32
12"	16"	105	6' 0"	18¼	27	25	34½	28½	38¼
13"	16"	105	6' 0"	21½	32½	29	40	33½	44½
14½"	20"	85	8' 0"	28	42¼	39	54	44	60
16"	20"	85	8' 0"	34½	52	47½	65	52½	72

*** When the Engine is set to run at the fast speed given in the upper part of the above table, or the maximum power named in the lower table is required from a Combined Engine and Vertical Boiler, the latter should be a size larger than the Engine. If the maximum power given in the upper part of the Table is required as a constant load, or if wood is to be used as fuel, the Vertical Boiler should be two sizes larger than the Engine. Special quotations will be given for these Engines with Boilers of larger sizes.**

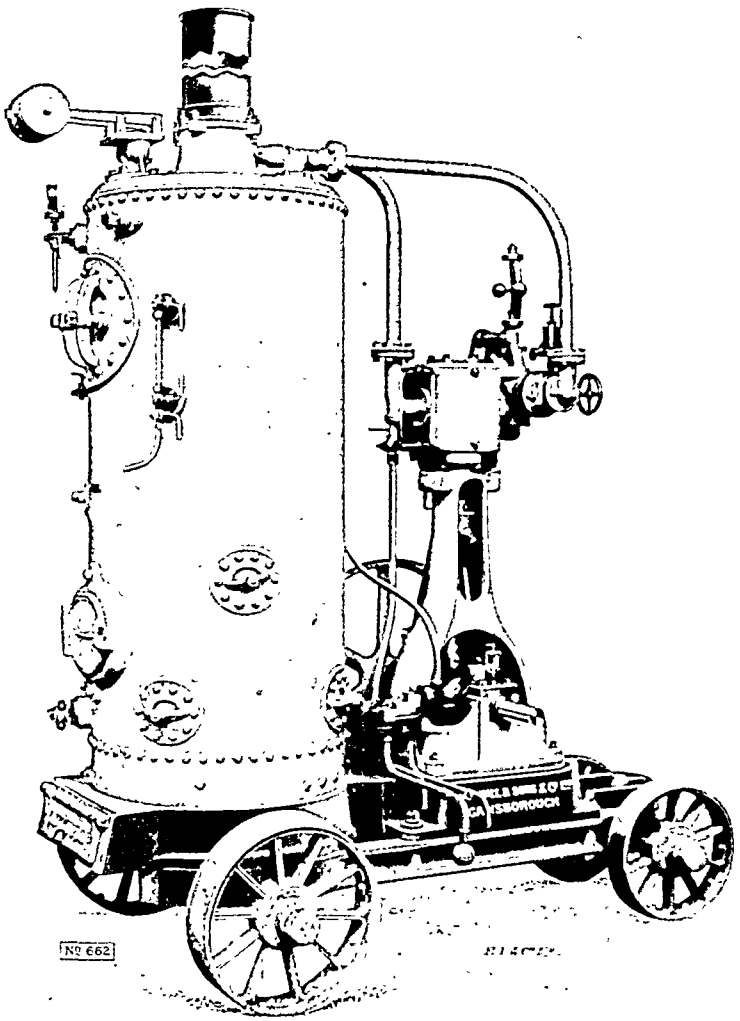
† *This pressure refers only to the separate Engines (see pages 6 to 8) when used with Boilers other than those of the Vertical Type, as we do not recommend Vertical Boilers being worked at more than 80 lbs. pressure.*

The **Class MP.** and **Class M.** Engines are specially adapted for driving **ELECTRIC LIGHT MACHINERY,** a large number being engaged on this work, with the most satisfactory results, and for this purpose the speeds can be somewhat increased if required. Drop-feed lubricators are fitted to the crank-shaft bearings, and these are so arranged that they may be refilled while the Engine is running. Special lubricating arrangements for long continuous runs can also be provided at a slight extra charge.

PORTABLE

VERTICAL STEAM ENGINES

Classes MP. and M.



The smaller sizes of these Engines, up to 7½″ cylinder inclusive, can be made **Portable** by mounting them on a Truck with four low Travelling Wheels as above, with Locking Gear and Shafts for draught; the Truck is so attached that it can readily be removed and the Engine put down as a fixture, if required.

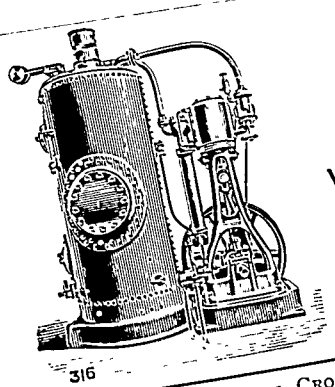
Above illustration is from a Photograph of a Class MP. Engine with Cross-Tube Vertical Boiler.
A sectional illustration and description of this Boiler is given on page 16.

For Prices see opposite page.

INDEPENDENT VERTICAL ENGINES

CLASS "M P" AND "M"

WITH CROSS TUBE OR HOPWOOD'S TUBULAR VERTICAL BOILERS

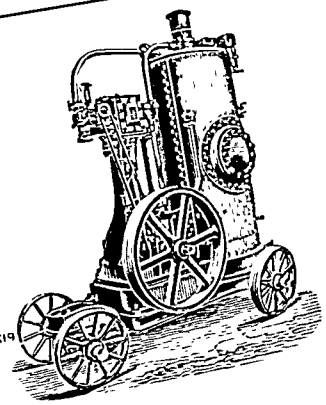

316

See Pages 2 and 3

Diam. of Engine Cylinder	Engine with Cross Tube Boiler Combined: Class "M P"	Code Words	Class "M"	Code Words	Extra for Hopwood's Tubular Boiler Code:— FOMENTED see page 17	Foundation Bolts and Plates Code:— AGRENTICOS	Vertical Water Heater with Brass Tubes Code:— DAMOTARY page 2 & 3	Lagging Boiler with Wood and Sheet Iron Code:— FERMENTURE	Packing: For Inland Transit	For Export	If Lagged extra
4½"	£78 0	FAULTINESS	£80	FERMOY	£2	£1 5	£4 0	£3	...	£1 0	£1 2 6
5½"	97 0	FAULTILY	100	FERNANDER	3	1 5	4 0	4	...	1 10	1 5 0
6½"	115 0	FATUOUS	118 10	FERNDEN	4	1 10	5 10	5	...	2 0	1 7 6
7½"	137 0	FATIGUING	142 10	FERRAND	5	1 10	5 10	5 10	...	2 10	1 10 0
8"	165 0	FATIFEROUS	171	FERRY	6	1 15	7 10	6	...	3 0	1 15 6
9"	186 0	FATHOMLESS	195	FERVENTLY	8	1 15	7 10	8	£3 0	4 0	1 17 6
10"	220 0	FATHOMING	231	FERVESCENT	10	2 5	10 0	10	3 15	5 0	2 5 0
11"	252 0	FATHERHOOD	266	FERVID	12	2 5	10 0	12	4 10	6 0	2 15 0
12"	285 0	FATEFULLY	300	FESTERED	14	2 15	15 0	14	5 5	7 0	3 10 0

PORTABLE VERTICAL ENGINES

See opposite Page


319

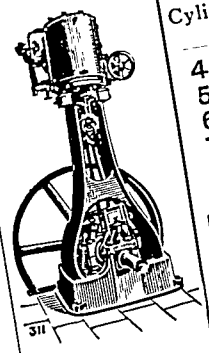
Diameter of Engine Cylinder	Engine with Cross Tube Boiler: Class "M P"	Code Words	Class "M"	Code Words	Extra for Hopwood's Tubular Boiler Code:— FOMENTED see page 17
4½"	£88 0	FOSTERDAM	£90 0	FILIGREE	£2
5½"	108 0	FOSTERED	111 0	FILIOLUS	3
6½"	129 0	FOTHERGILL	132 10	FILIPOVA	4
7½"	150 0	FOULGER	155 10	FILLIBEG	5

Water Heater, Lagging and Packing for export as above

INDEPENDENT VERTICAL ENGINES

CLASS "MP" AND "M" WITHOUT BOILERS

See Pages 6 to 8


311

Diam. of Cylinder	Class "MP" Engine Pages 6 & 7	Code Words	Class "M" Engine Page 8	Code Words	Force Pump Code:— AGRAULUS	Foundation Bolts Code:— AGRENTICOS	Deep Cast Iron Base	Condenser Code:— FLATHOLM Page 15	Packing: For Inland Transit	For Export	For Export Condenser
4½"	£31 10	FINALITY	£33 10	FISTULA	£3 10	0 15	£4 15	...	0 15	£1 0	...
5½"	37 10	FINEDRAWN	40 10	FIXEDNESS	3 10	0 15	4 15	...	£1 0	1 10	£2
6½"	48 0	FINERY	51 10	FLABELLUM	4 0	£1 0	5 10	£35	1 10	2 0	2
7½"	58 10	FINESPUN	64 0	FLABRUM	4 0	1 0	5 10	35	2 0	2 10	2
8"	71 0	FIREARMS	77 0	FLADBURY	5 0	1 5	9 10	35	2 10	3 0	2
9"	85 0	FIREBALL	94 0	FLAGEOLET	5 0	1 5	9 10	35	3 0	4 0	3
10"	104 10	FIRESHIP	115 10	FLAGITIOUS	6 10	1 10	10 0	45	3 15	5 0	3
11"	119 10	FIRESTICK	133 10	FLAGON	6 10	1 10	10 0	45	4 10	6 0	4
12"	139 0	FIREWOOD	154 0	FLAGRABAT	8 10	2 0	13 10	55	5 5	7 0	5
13"	154 10	FIRSTLING	172 10	FLAKINESS	8 10	2 0	13 10	65	6 0	8 0	6
14½"	*237 0	FISTOME	*257 0	FLAKERY	NO PUMP	3 10	27 0	80	7 10	15 0	6
16"	*276 0	FISTONDRY	*301 0	FLAKESOME	NO PUMP	3 10	27 0	80	9 0	18 15	

*These prices include Fly-wheel Barring Gear, a 3rd Bearing, and A Standard for the outer end of the Crank-shaft beyond the Fly-wheel.

Special Lubricating arrangements for long continuous runs can be applied to these Engines at a slight extra charge.

Code Word—FERMENTING

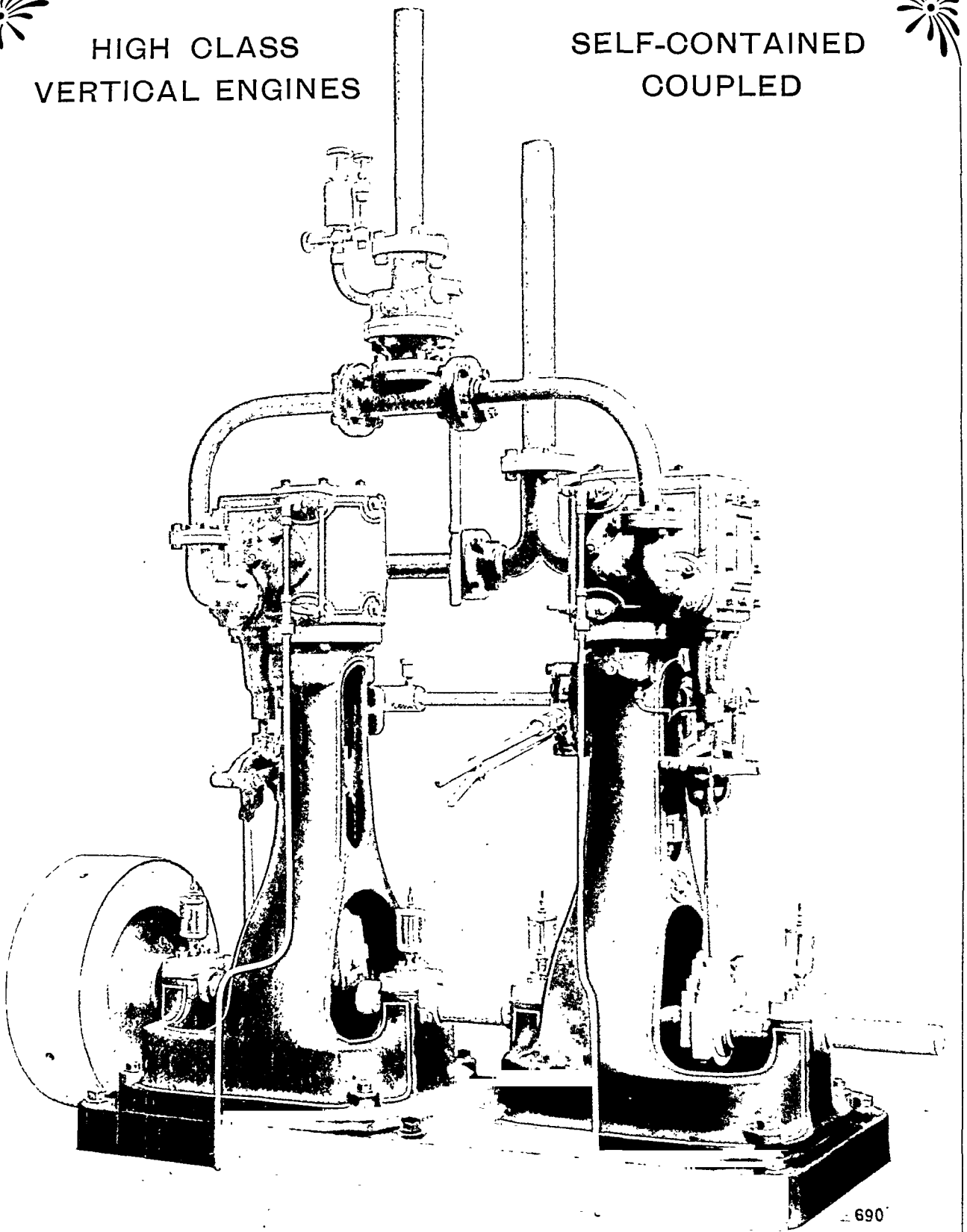
INDEPENDENT VERTICAL ENGINES COUPLED

PRICES ON APPLICATION

See Pages 12 and 13.

HIGH CLASS VERTICAL ENGINES

SELF-CONTAINED COUPLED

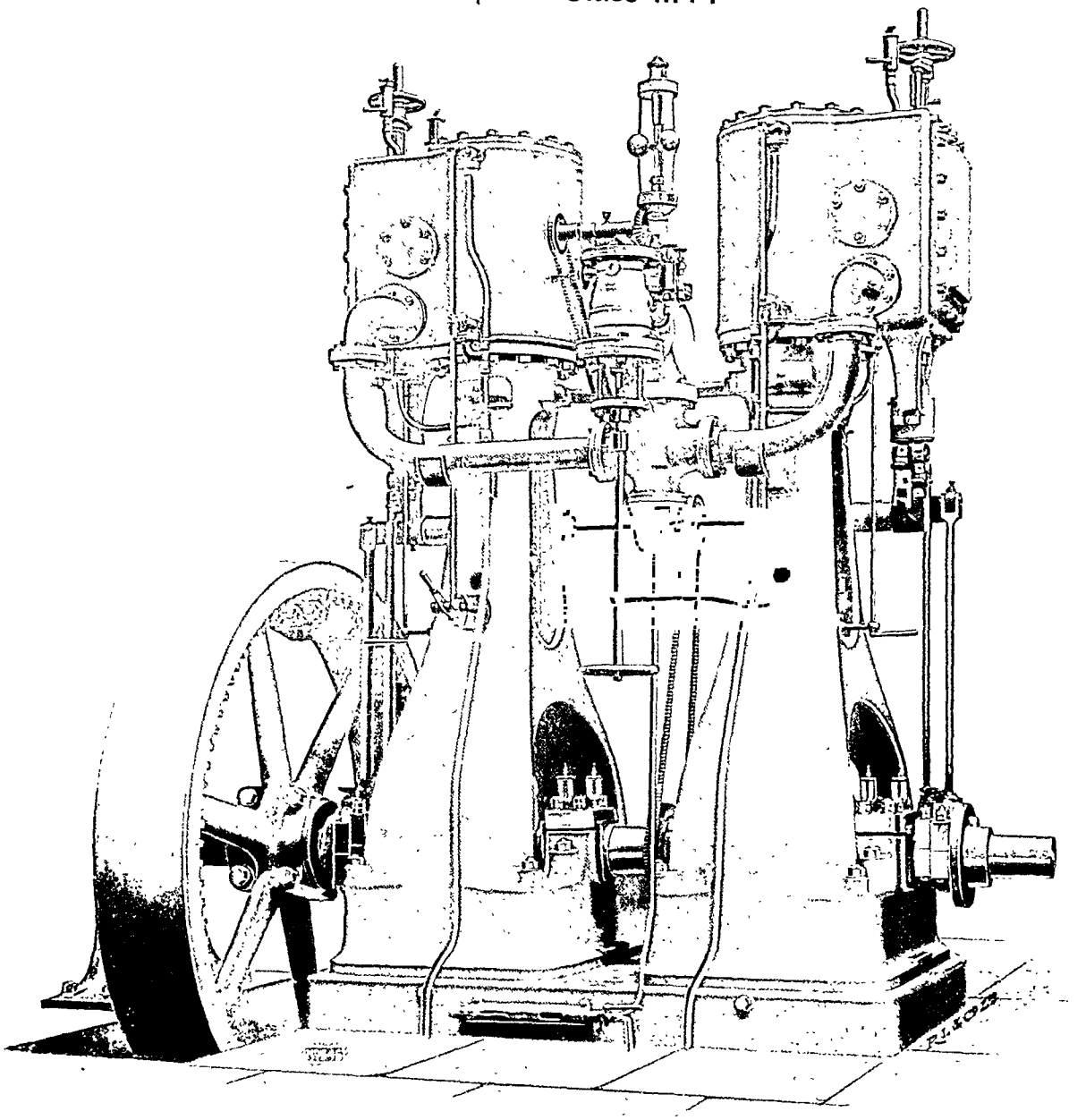


Pair of 4½" Engines on C.I. Base, with Link Motion Reversing Gear.

HIGH-CLASS

SELF-CONTAINED VERTICAL ENGINES

Coupled—Class M P.



The above illustration is from a Photograph of a pair of our 14½ in. Cylinder Vertical Engines, **Class M P**, coupled, and mounted on massive cast-iron base. It is sometimes convenient to couple a pair of the larger Vertical Engines, as above, for situations where there is ample head-room, but not sufficient ground space available to put down a Horizontal Engine of sufficient power.

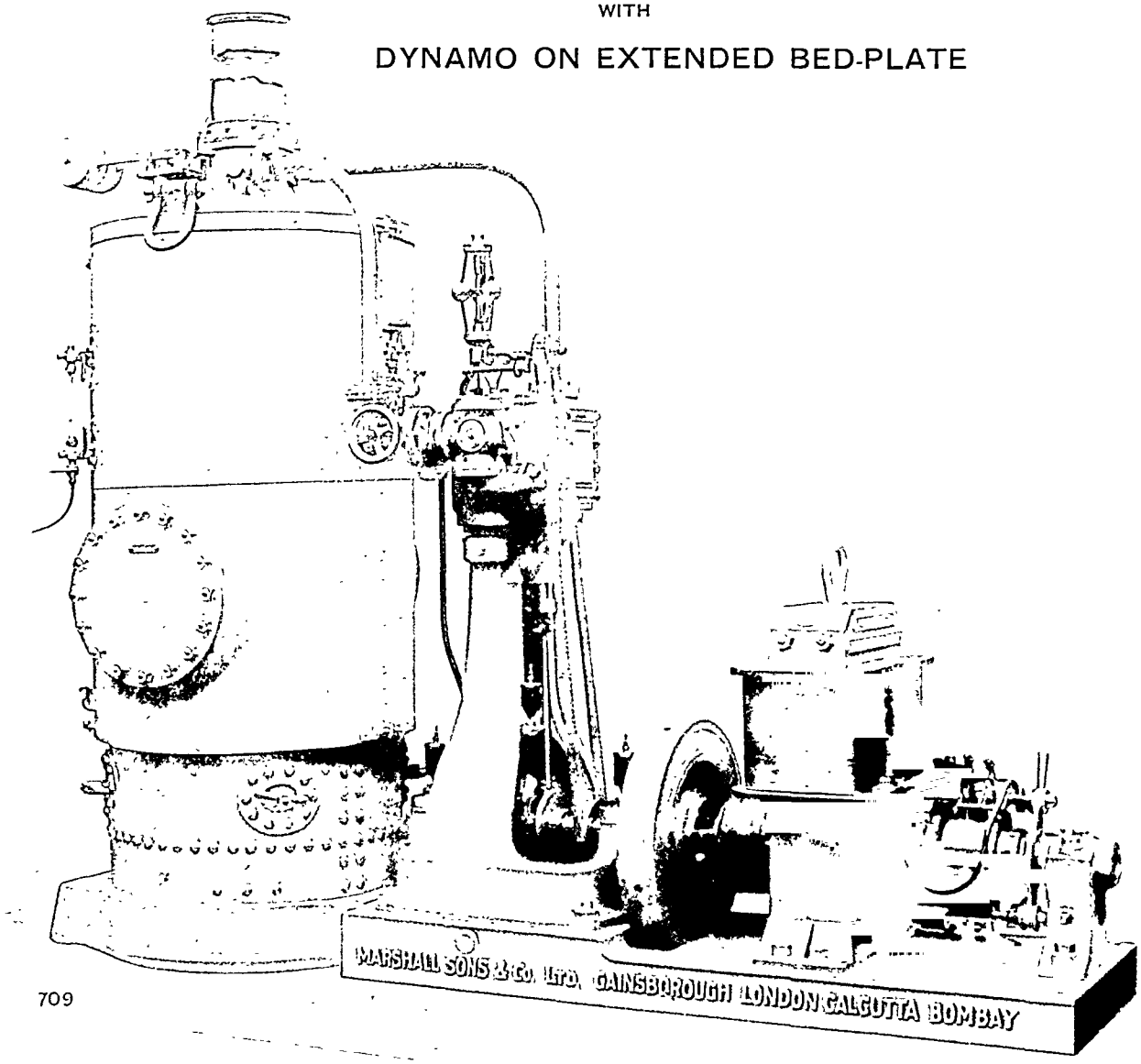
The Engine from which the above Photograph was taken was fitted with Meyer's Variable Expansion Gear on each cylinder. This item, and also the steam trap shown in the front of the cast-iron base, are not included in our price.

CLASS "M P"

VERTICAL ENGINE & HOPWOOD BOILER

WITH

DYNAMO ON EXTENDED BED-PLATE

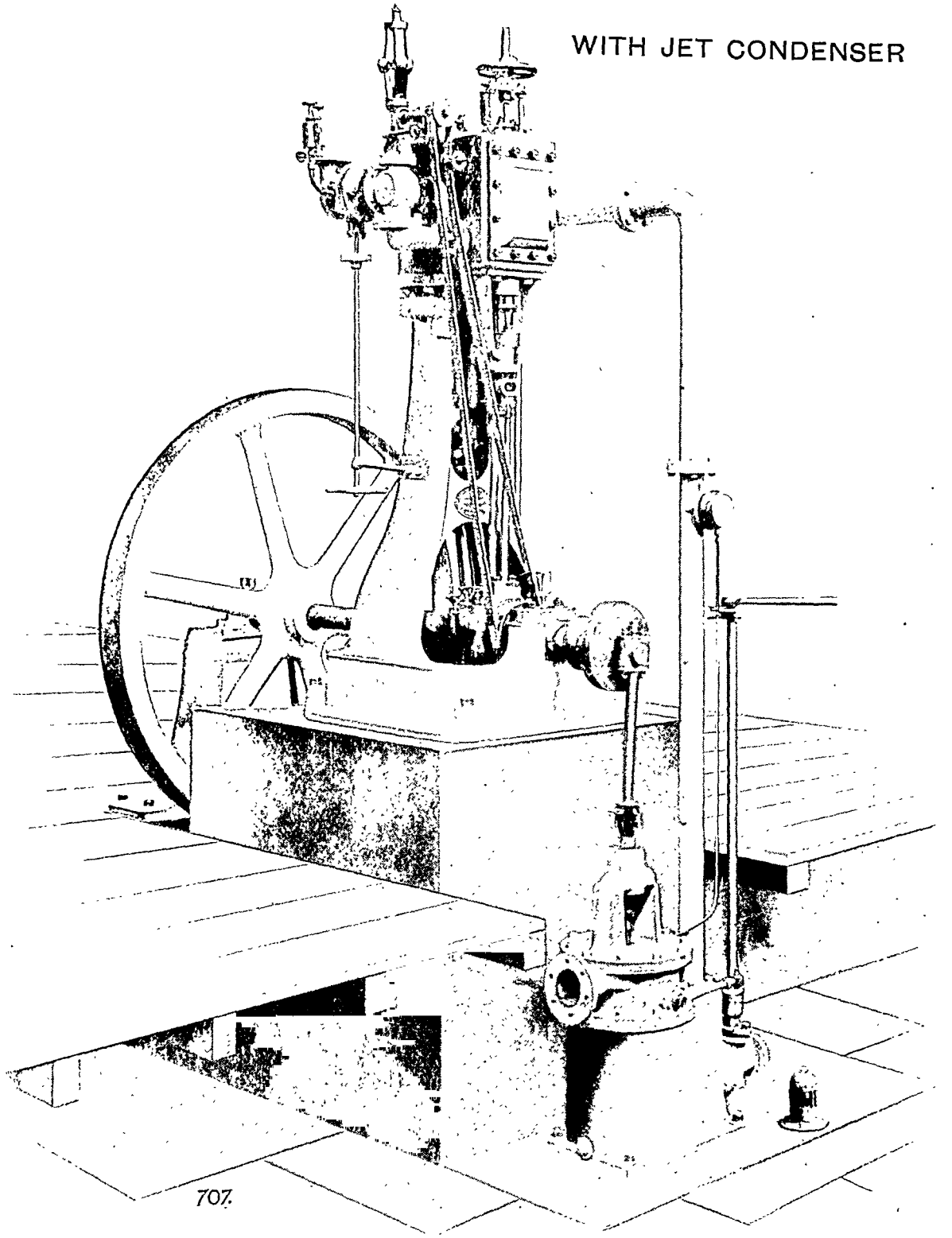


In the above illustration the Engine is one of our standard type, **Class "M P."** as described on pages 2 to 9, but we can also supply several sizes of high-speed open fronted Vertical Engines, with piston valves, for running at higher speeds than our standard type.

The Boiler is of Hopwood's Patent Tubular type, more fully described on page 17, and is lagged with wood and covered with sheet iron.

Class "M P" VERTICAL ENGINE

WITH JET CONDENSER



In situations where space will not admit of a Horizontal Engine being put down, and where there is sufficient water available for condensing purposes, greater economy can be obtained from a Vertical Engine by the addition of a Jet Condenser, as shown above.

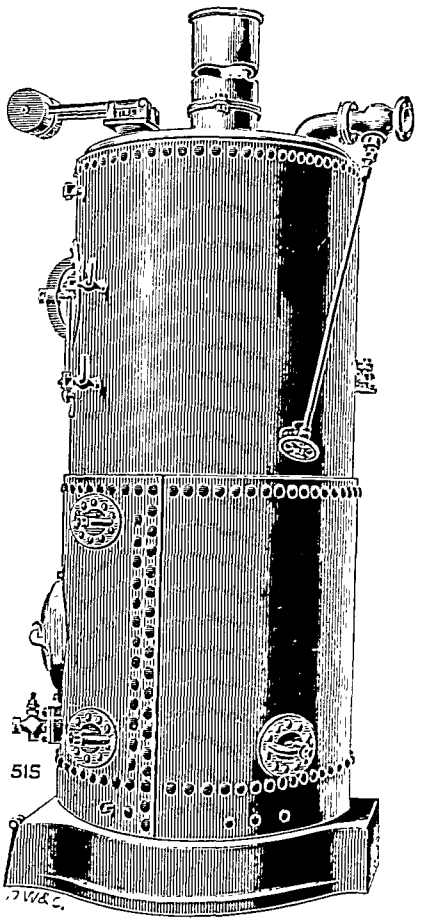
These Condensers can be applied to any of our Class "M P" Vertical Engines.

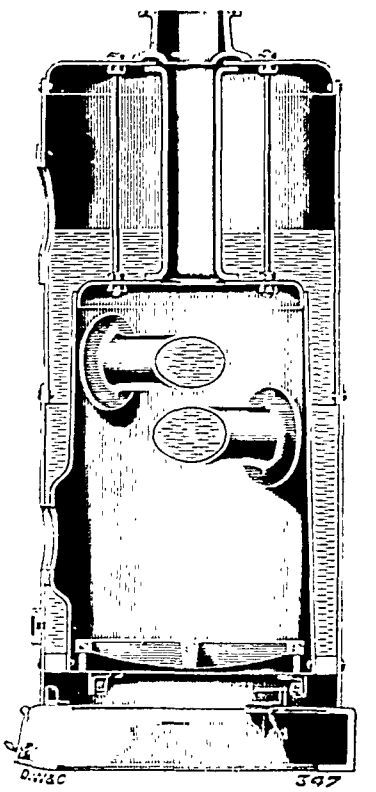
The outer Bearing and "A" Standard beyond the Fly-wheel, and the MEYER'S Variable Expansion Gear on the Cylinder are not included in our list prices.

For Prices see page 11

VERTICAL BOILERS

CROSS-TUBE TYPE





Where space is limited and economy in fuel is not of the utmost importance, the Cross-Tube Vertical Boilers are very useful, as they are simple and easy to manage, and steam well with inferior fuel.

We manufacture these from 2 to 14 H.P. inclusive, and have usually a number of our standard sizes in stock ready for quick delivery. They are rivetted together by patent machinery, the **uptake** is of **extra thickness** and the upper part of the fire-box is stayed to the crown of the Boiler by a number of circular stays with double nuts: the Vertical seams in the shell are **double rivetted,** they have a **solid** ring at the bottom of the water space and round the fire-hole, compensating rings round all the mud-holes, and they are of ample strength for **80 lbs.** working pressure. For further particulars, with list of fittings, &c., see page 5.

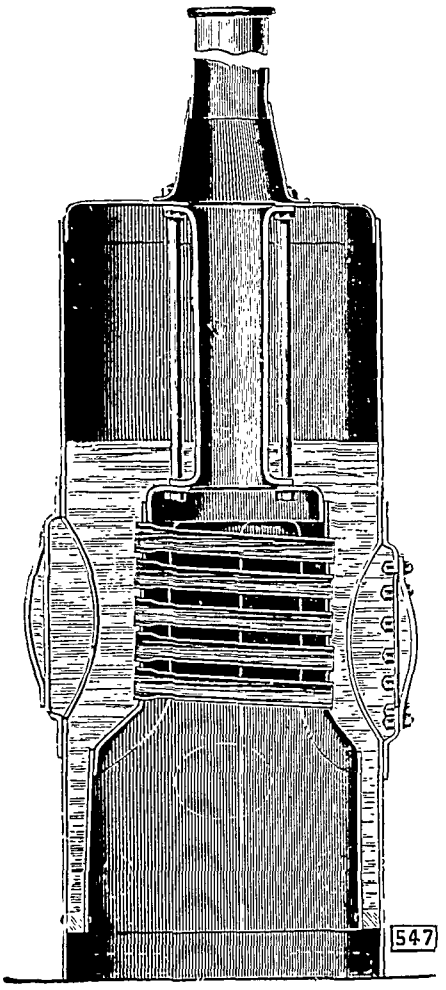
The cast-iron Ashpit Base, with damper, can be supplied or not as preferred. Injector or Donkey Pump for feeding, and Lagging if required, are extra.

Prices and full specification on application.

HOPWOOD'S PATENT

TUBULAR VERTICAL BOILER

Applicable to our Horizontal or Vertical Engines up to 12″ diameter of cylinder



Having had frequent enquiries for a Boiler to be used in connection with our Vertical Engines that would be more economical in fuel than the ordinary Vertical Boiler with cross tubes, and not occupy so much space as a Boiler of the Locomotive Multitubular type, we have made arrangements for the manufacture of Hopwood's Patent Tubular Vertical Boiler as shown in the accompanying illustration.

This Boiler possesses the following advantages over the ordinary cross tube type:—increased heating surface, improved circulation, easy access for examination, cleaning and repairs. It will be seen on referring to the illustration that two of the sides of the fire-box are flattened so as to form tube plates. A number of water tubes are carried across the fire-box, and fixed in these plates, the tubes lying a little higher at one end than the other in the upper part of the fire-box. By means of these tubes a large amount of effective heating surface is obtained.

In the three smallest sizes—2, 3, and 4 H.P.—a manhole is placed in the upper part of the shell, with external strengthening ring, internal cover and cross-bars, but in the larger sizes of 5 H.P. and upwards, this extra manhole is not necessary, as access can be got to the interior of these larger Boilers from the two large hand-holes, one on each side of the Boiler, and therefore these serve the purpose of manholes.

The ends of the tubes are opposite to these manholes, which have strong steel external covers with faced joints, as shown in the illustration on pages 3 and 17, so that the tubes can be easily cleaned or removed when required.

The fire-box leans a little to one side, which causes one end of the water tubes to lie higher than the other; the upper part of the fire-box is stayed to the crown of the Boiler by a number of circular stays with double nuts, the same as in our ordinary type, and the Boilers throughout are made of suitable strength for a working pressure of **80 lbs.** per square inch.

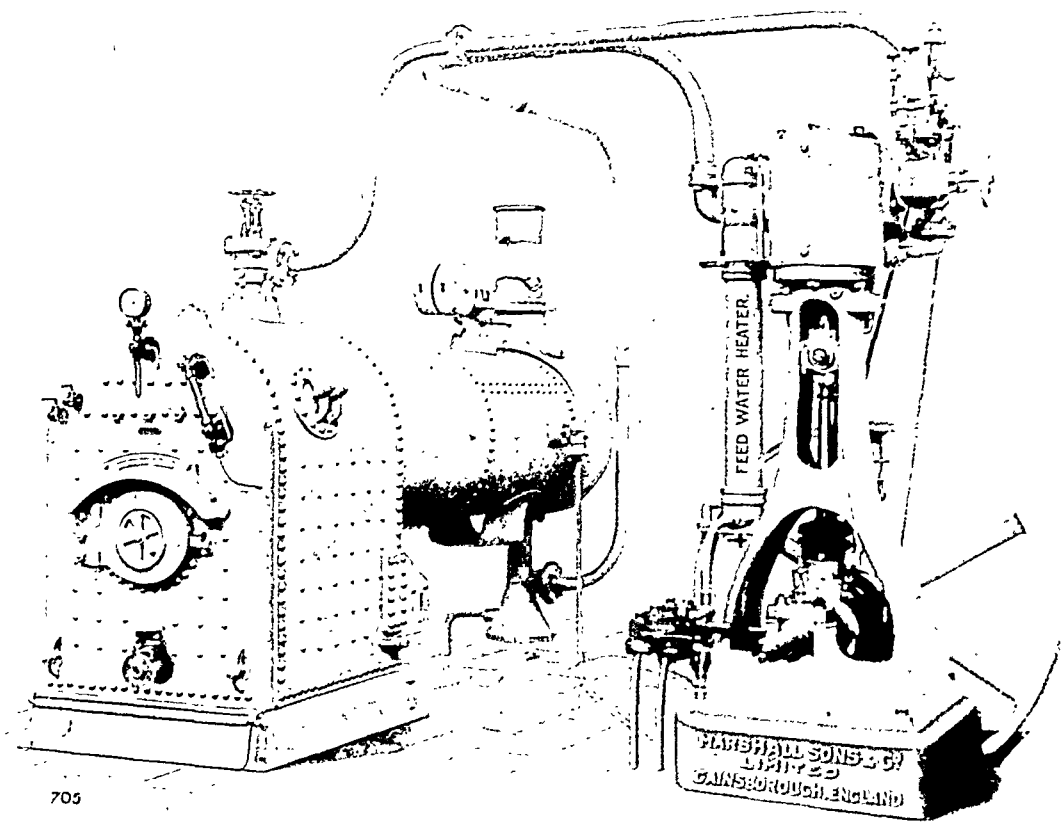
These Boilers can be lagged with wood and covered with sheet-iron if desired, as shown on page 14 at the extra cost named in our List.

For Prices of Classes M P. and M. Vertical Engines with Hopwood's Boilers, see page 11.

ARRANGEMENT OF

CLASS M.P. VERTICAL ENGINE

WITH LOCO-MULTITUBULAR BOILER



We supply a large number of **Independent Vertical Engines** to work with separate **Locomotive Multitubular Boilers,** as shown above, and, where the necessary space can be afforded, this arrangement is found very advantageous, especially for the larger Engines of this class, on account of the economy in fuel consumption by using a Boiler of the Locomotive or "Britannia" Multitubular type.

The **Engines** are constructed as described on pages 4 to 9, and 12 to 15 and are the best of their kind, being fitted with all the most modern improvements suggested by a lengthened experience in the manufacture of Engines of this class.

The **Boilers** can be of Loco. type (as shown above) or of the Britannia type (particulars of which can be had on application.) They can either be fed by means of a Force Pump attached to the bottom of the Engine Standard as shown; or an Injector or Donkey Pump can be employed either in lieu of or in addition to the Force Pump.

These Boilers can be constructed with the Fire-box to burn coal or wood, or they can be furnished with special appliances to adapt them for consuming straw, cotton stalks, jungle grass or other vegetable matter as fuel.

The Boiler can be placed on either side of the Engine, or in any other position that may be more convenient, and when ordering please give a rough sketch showing the relative positions of the two with the distances apart, so that we may send the necessary piping.

Prices and full Particulars on application.

VERTICAL WINDING ENGINE

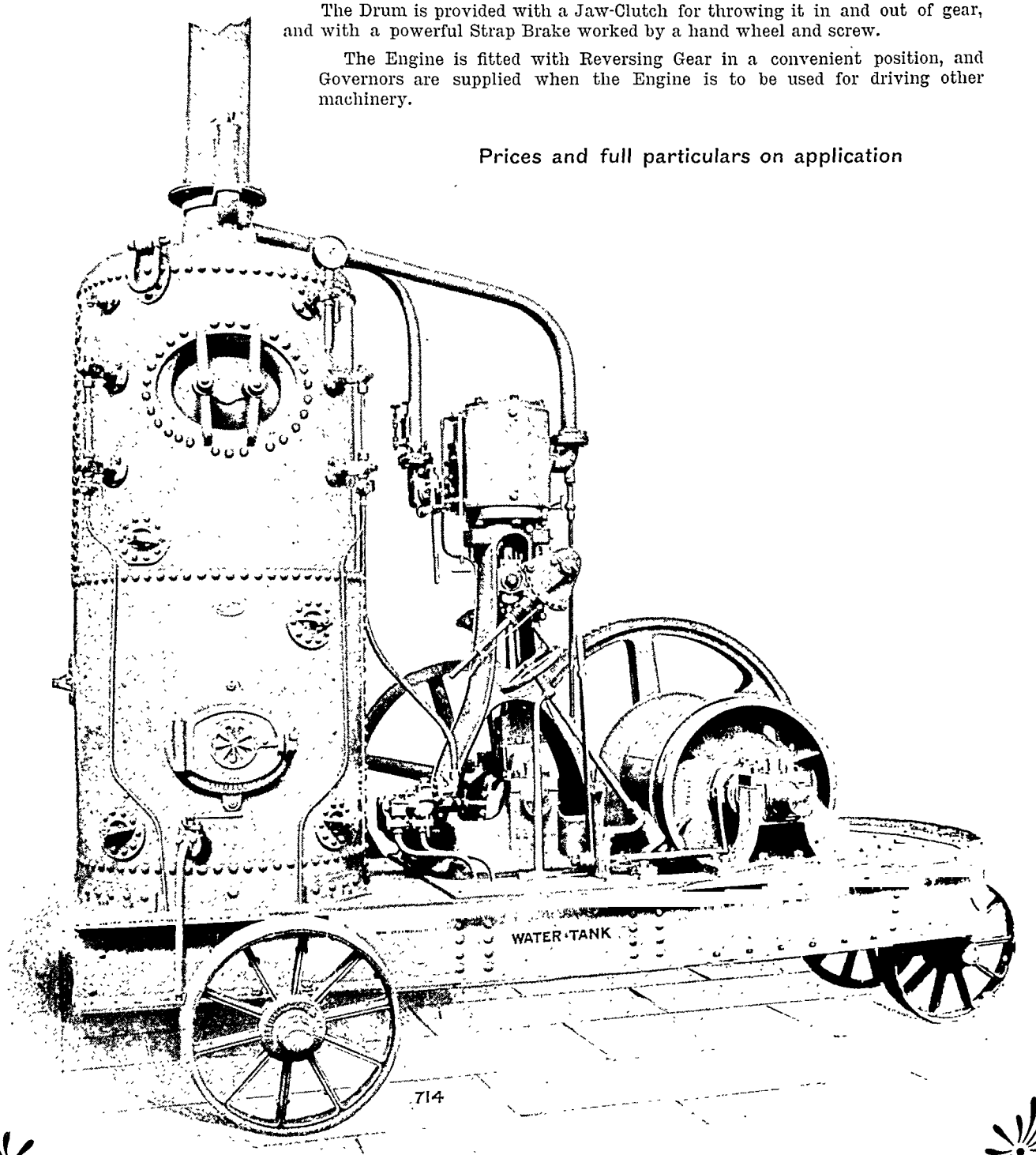
This Illustration shows a simple arrangement of Winding Engine, which will be found very handy for Mining, Builders' and Contractors' work; and also for use on Dock sides, on the decks of ships, in mines, and other purposes. We have patterns for several sizes, and shall be pleased to send full specification of our nearest size to suit customers' requirements.

The Engine and Boiler can either be mounted on Wrought-Iron Travelling Wheels as shown—complete with shafts—or they can be secured to a brick or wood foundation in the usual way, or to the deck of a vessel. When required for hoisting purposes only, a hoisting barrel can be supplied instead of the Winding Drum shown in the illustration.

The Drum is provided with a Jaw-Clutch for throwing it in and out of gear, and with a powerful Strap Brake worked by a hand wheel and screw.

The Engine is fitted with Reversing Gear in a convenient position, and Governors are supplied when the Engine is to be used for driving other machinery.

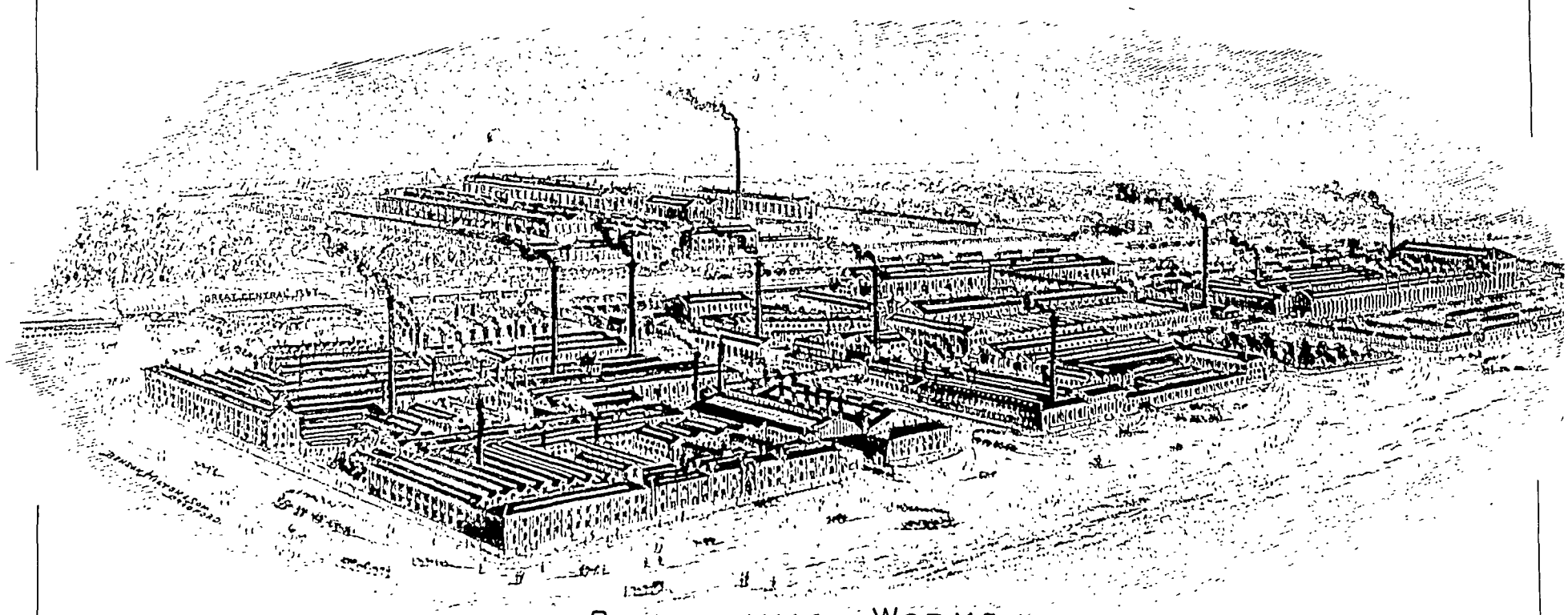
Prices and full particulars on application



MARSHALL, SONS & CO., LIMITED

GAINSBOROUGH, LONDON, CALCUTTA, BOMBAY, and DUNEDIN, N.Z.

Area of Works, 28 acres. Employing 3,500 hands. Upwards of 75,000 Engines and Boilers made.
The GRAND PRIX and GOLD MEDAL, Paris, 1900.



BRITANNIA WORKS.

GENERAL ENGINEERS AND MANUFACTURERS of High-Class Horizontal Engines up to 1000 H.P. Vertical Engines with and without Boilers. Undertype Engines, high pressure and compound. Electric Light Engines. Portable and Semi-Portable Engines, Road Rollers and Traction Engines. Thrashing, Grinding and Sawing Machinery. Tea Preparing Machinery. Gold Dredging Machinery, &c.

MARSHALL, SONS & CO. LTD

Britannia Iron Works

GAINSBOROUGH, ENGLAND

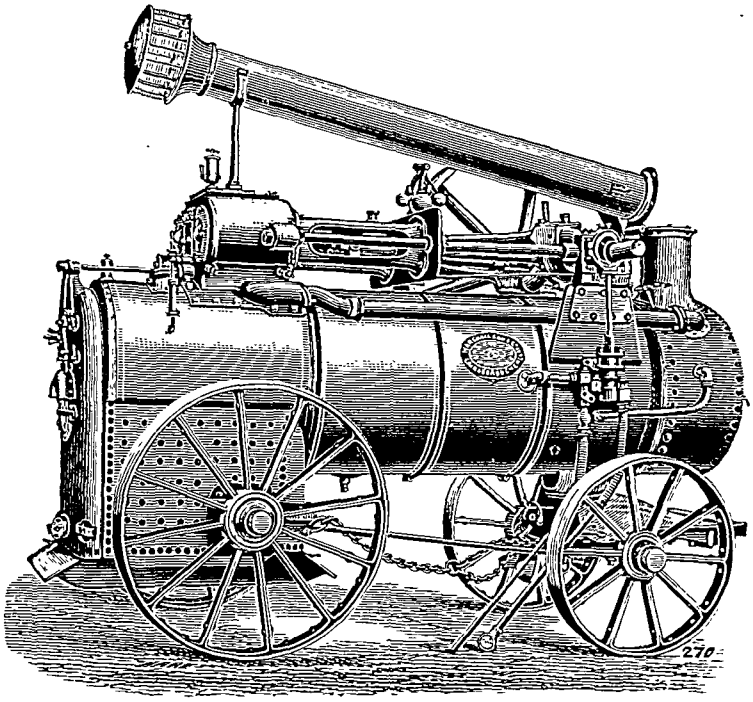
ADDRESS FOR TELEGRAMS—"MARSHALLS, GAINSBOROUGH." NATIONAL TELEPHONE—No. 10.

SECTIONAL CATALOGUE

OF

PORTABLE ENGINES

AND OTHER MACHINERY



SUITABLE FOR CONTRACTORS, BUILDERS, &c.

London Offices, Showrooms and Stores

(Where we keep a Stock of Portable Engines, Portable Locomotive Boilers, &c. for Sale and FOR LETTING OUT ON HIRE; See page 25):—

MARSHALLS' BUILDINGS, 79 FARRINGDON ROAD, E.C.

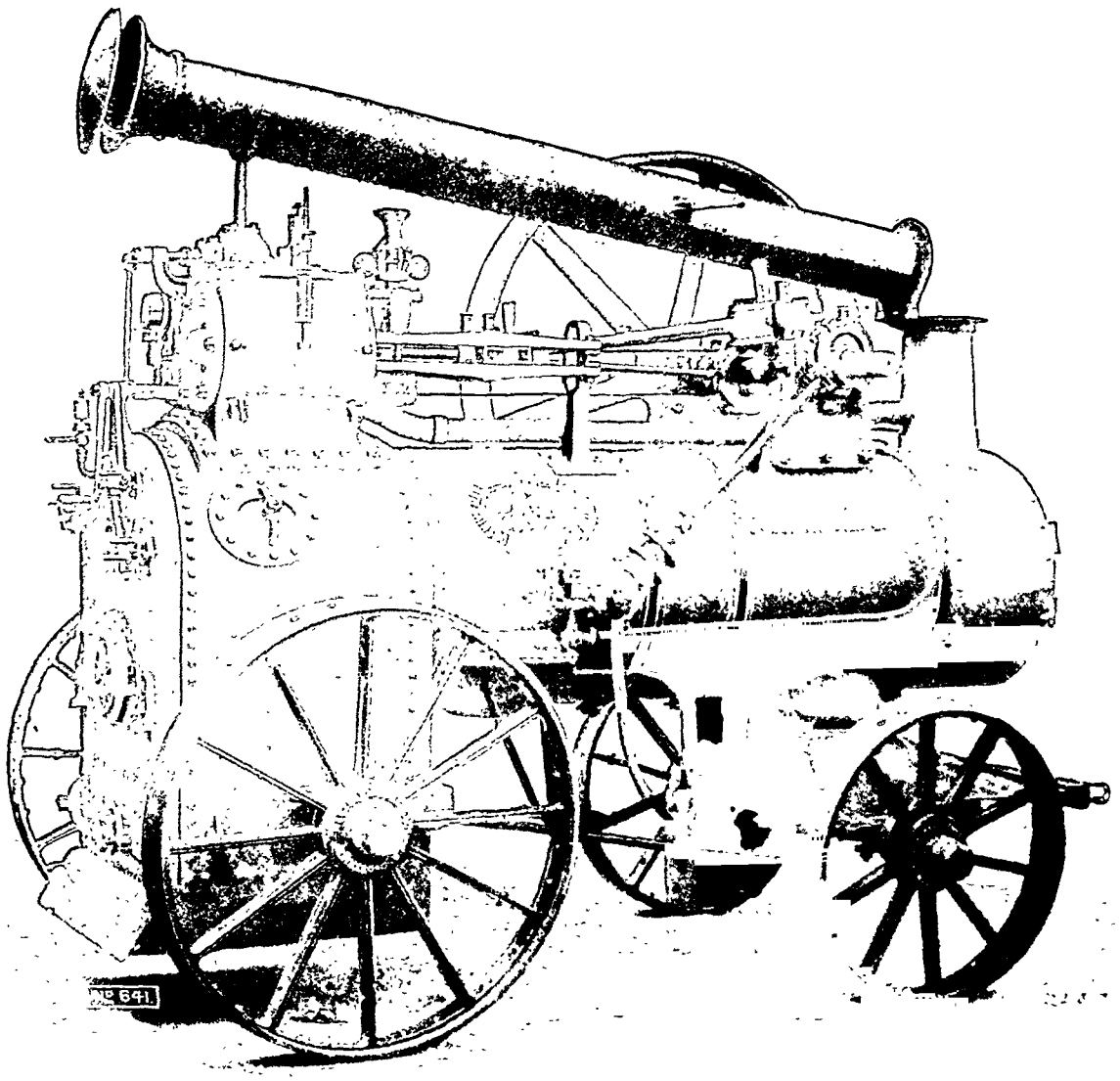
Address for Telegrams—"ENGINE, LONDON" Telephone—No. 648 HOLBORN

76360 12 02 JOHN BELLOWS, GLOUCESTER 231263

NEW PATTERN

PORTABLE STEAM ENGINE

WITH ONE CYLINDER



The above Illustration is from a Photograph of a 7 Nominal H.P. Engine of our new type, and represents our latest construction from 3 H.P. to 7 H.P. inclusive.

For Prices see page 26 of this List

DESCRIPTION OF OUR NEW PATTERN

PORTABLE STEAM ENGINES

WITH ONE CYLINDER

AS ILLUSTRATED ON PAGES 2 AND 4

These Engines are suitable for driving Grinding and Crushing Mills, Brickmaking Machines, Mortar Mills, Centrifugal and other Pumps, Circular Saws and other Wood Working Machines, Cotton Gins, &c. and to the general purposes of Contractors, Builders, and others. They are constructed of the best material, with first-class workmanship throughout, being equal in finish to the best Locomotive work, are of large proportions, with ample strength and heating surface in the Boilers and are unsurpassed for efficiency, economy and durability in working. They have recently been remodelled throughout and now embody the following important advantages and improvements:—

1.—**Great Economy in Fuel** obtained by the following means: The Cylinders are steam jacketted, felted and covered on the outside with plate iron; a simple and efficient Feed Water Heater is applied in connection with the exhaust steam, which heats the feed water to a high temperature; and the strength of construction throughout admits of a high working steam pressure, and every Engine is fitted with Patent Variable Expansion Eccentric, as explained in paragraph 12.

2.—**Cylinder of large Area and Special Construction.** The Cylinders are made of cold blast iron, with the outer barrel and valve chest in one casting; the inner or working barrel is cast separately of special hardness and is afterwards tightly forced into the outer casing, thus forming a perfect jacketted Cylinder, which for obvious reasons is much superior to the steam jacketted Cylinder cast with the working barrel in one piece. The Steam is taken up round the Cylinder and in at the top and this insures it entering the Cylinder in its driest possible condition. In Engines of 3 horse-power to 7 horse-power, the Cylinder flanges are extended beyond each end of the Cylinder, as well as at the sides, giving a large bearing on the boiler; in those of 8 H.P. and upwards the Cylinder is constructed with a planed base mounted on planed steel girders, rivetted on External Shell of Fire-box, and there is a stay between the Cylinder and a Sliding Crankshaft Carriage on the right-hand side.

3.—**Size and Construction of Boilers.** In addition to being of large capacity and provided with ample heating surface, the greatest care is bestowed on their manufacture by means of an extensive plant of the most modern machinery. The Fire-box is made of Best Yorkshire Iron, or Steel of special quality, and at the upper part of the Fire-box Shell, there is a man-hole on one side and a hand-hole on the other, to give access to the internal fire-box for cleaning, &c. Angle Iron is entirely dispensed with, and all the plates are flanged by hydraulic machinery; the edges of the plates are planed, the smoke-box tube plates turned, the rivetting is done by special machinery, and the boilers throughout are of ample strength for a working pressure of **100 lbs. per square inch.**

4.—**Extra Strength of Parts.** All the parts have been revised and strengthened to which is combined neatness of design and high finish.

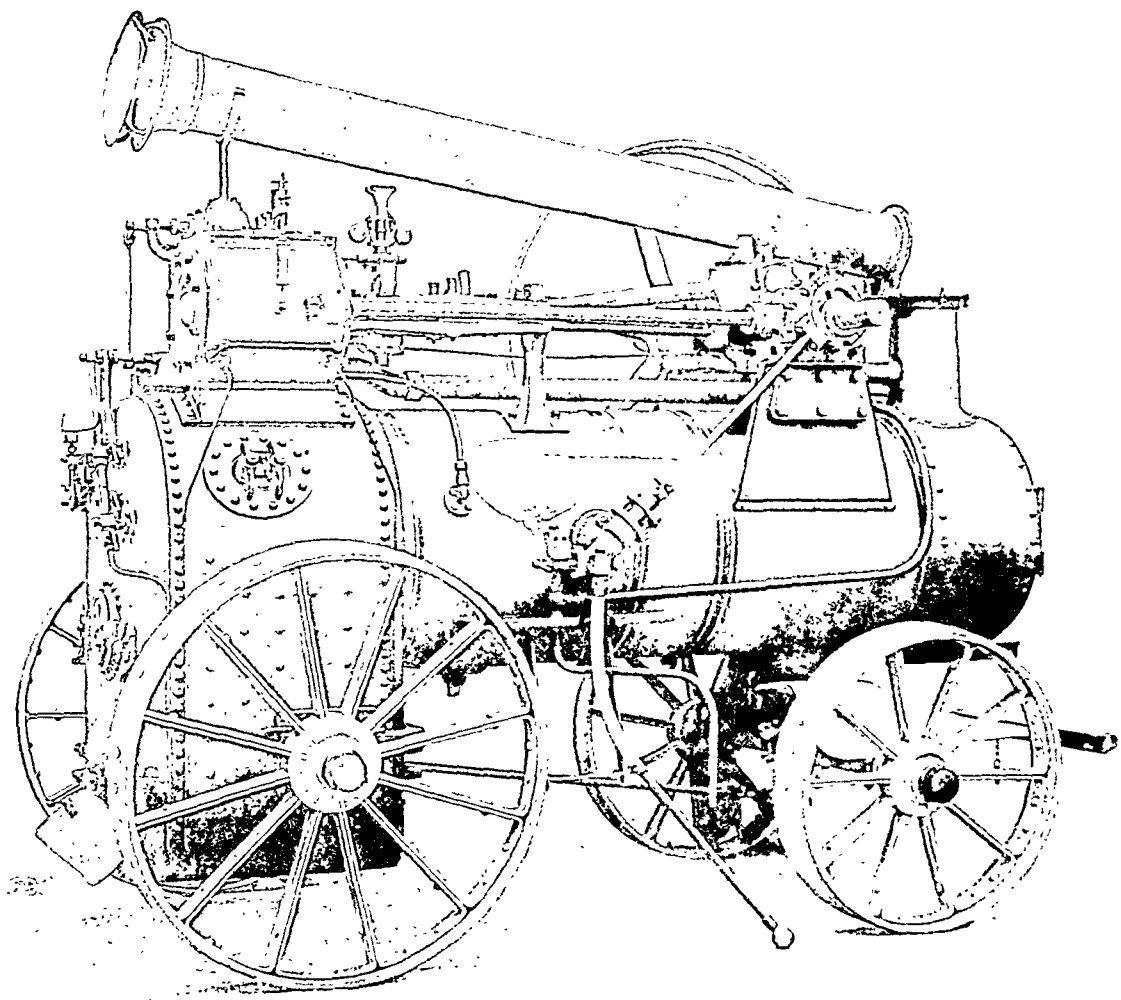
5.—**Simplicity of Arrangement** and ease of access to all internal details, all parts of the Engine being outside the Boiler.

(CONTINUED ON PAGE 5)

NEW PATTERN

PORTABLE STEAM ENGINE

WITH ONE CYLINDER



The above Illustration is taken from a Photograph of an 8 Nominal H.P. Engine of our new type, with Cylinder mounted on planed steel girders, and with stay between Cylinder and Crank Shaft Bearing. We can supply Single Cylinder Engines of this type from 8 to 12 Nominal H.P.

For Prices see page 26 of this List.

6.—Steel Crank-shaft Brackets, as shown on pages 2, 4 and 6 to 10, on Engines of 3 H.P. and upwards, double rivetted to barrel of Boiler and strongly stayed, supporting special carriages firmly bolted thereto with turned bolts for carrying the Crank-shaft; these Brackets take a large bearing on the Boiler. They obviate the possibility of leakage, and are stronger and lighter than the cast-iron saddle bolted to the Boiler.

7.—Crank-shaft of Steel, bent from a single bar without welding, and arranged to give off the power on either or both sides of the Engine at once.

8.—Steel Piston and Valve Rods.

9.—Lubricating Boxes fitted to all the bearings.

10.—Efficient Continuous Force Pump, of the diagonal type, certain in action and not liable to derangement. In Engines from 3 to 9 H.P. we now use a flanged steel plate, as shown on pages 2, 4, and 9, rivetted on the Boiler, faced to receive the pump, and projecting beyond the lagging so that the pump can at any time be removed by slacking off 4 nuts, and the risk of leakage between the pump and Boiler is rendered impossible.

11.—An Improved Cross Arm Quick Speed Governor, as shown on pages 2, 4 and 9, is now attached to the Cylinder instead of being bolted on to the Boiler, is very powerful and sensitive, actuating an equilibrium Throttle Valve, which together form a very efficient speed regulator, much more durable and reliable than the ordinary Governors with large heavy balls.

12.—Variable Expansion Eccentric. We still continue to apply this valuable improvement to all our Engines without extra charge. This invention enables the admission of steam being varied from full power down to as low as one-fourth, with proportionate economy in fuel, according to the power given off. It surpasses all prior arrangements for this purpose in its mechanical exactness, simplicity and non-liability to derangement. Only one Eccentric and Slide Valve are used, thus no extra wearing parts are introduced. It also forms a simple reversing apparatus, enabling the Engine to be run in either direction, to suit the machinery to be driven. Taking into consideration the varied uses to which Portable and Vertical Engines are applied, the advantage of an arrangement of this description is evident. Simple instructions for the adjustment of this apparatus, which may be readily understood by any ordinary driver are sent out with every Engine.

13.—Our Improved Wrought-Iron Wheels, as shown on pages 2 to 8, for hot climates especially, are most advantageous. Great care has been bestowed upon their design and special machinery put down for their manufacture. They embody the greatest possible strength of construction, and will be found practically indestructible.

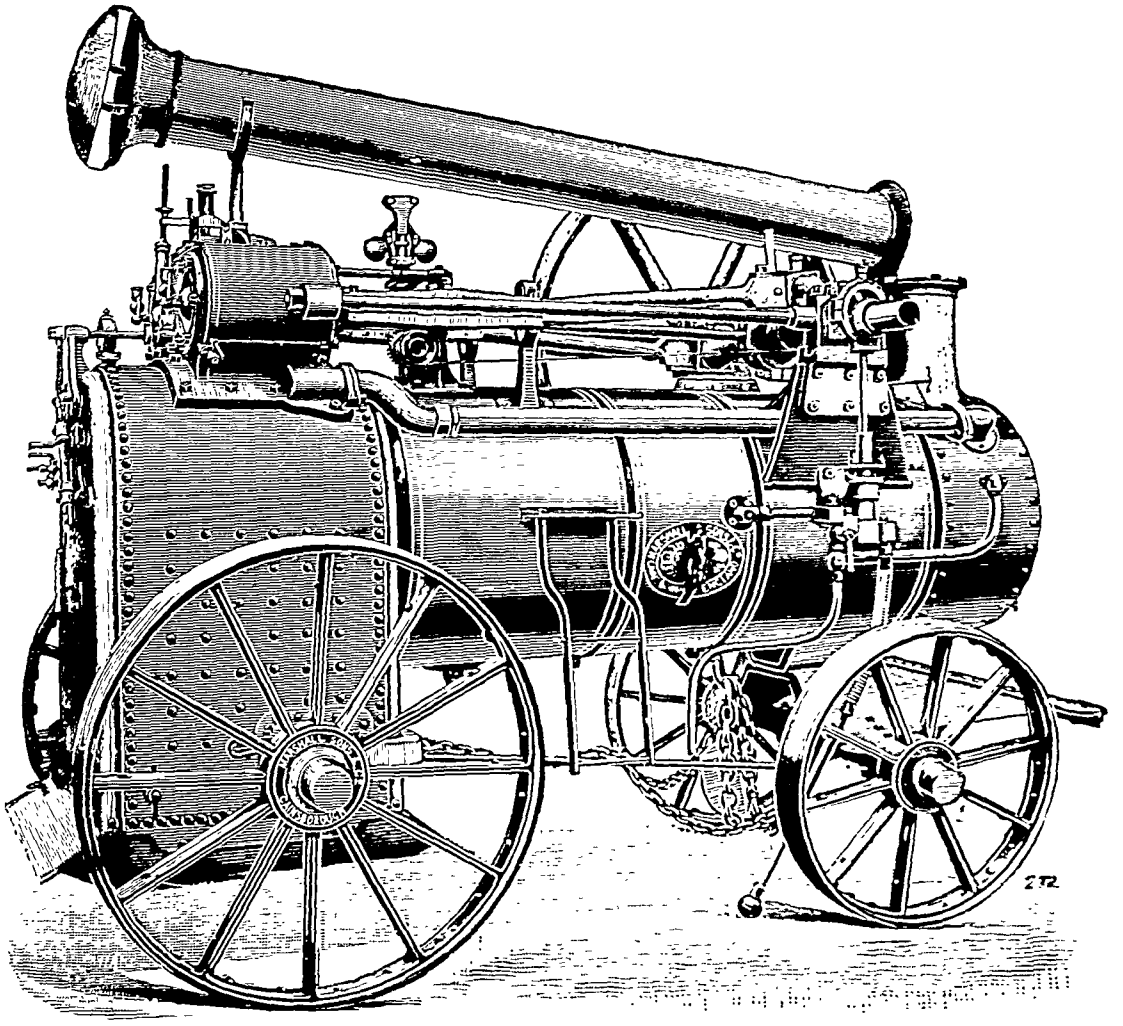
14.—Steel Plate Undergear. In lieu of the usual Wood Fore-Carriage, we are now forming the turn plate and attachment for the Shafts out of a flanged **Steel** Plate, as shown on pages 2, 4, 6 and 7, with suitable connection to the axles; this renders the Fore-Carriage exceedingly strong and durable for all climates.

15.—Great Durability, owing to strength of parts and the large wearing surface provided in all the Brasses and Bearings.

16.—Complete Equipment.—Each Engine is thoroughly tested under steam at a high pressure before leaving the Works, is fitted with Pressure Gauge, Steam Whistle and second Lock-up Safety Valve, inclusive in the List price, and is sent out with a complete set of case-hardened Spanners, Firing Tools, Funnel, Tube Brush, Oil Feeder, and Waterproof Cover, and furnished with Lock Chains and Shoe.

PORTABLE STEAM ENGINE

WITH TWO CYLINDERS



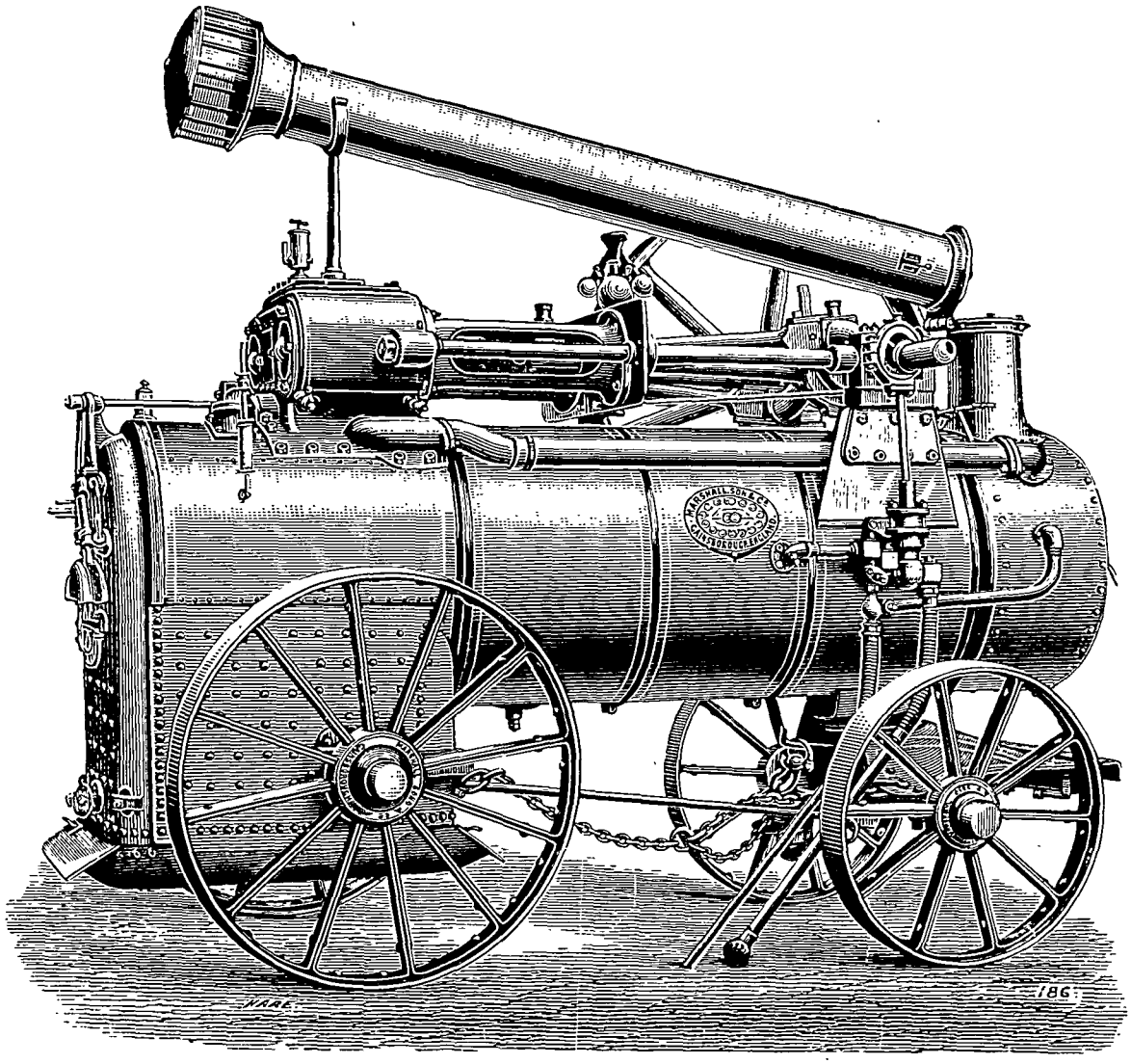
Manufactured from 8 to 12 Horse Power inclusive.

These Engines are similar to our Single Cylinder Engines, referred to on pages 2 to 5, the cylinder casting is flanged at each end as well as at the sides to give an extended bearing on the boiler. They are also provided, in the 10 and 12 H.P. sizes and upwards, with wrought-iron stays between the cylinders and the crank-shaft carriages, and the latter slide in dove-tailed castings to allow for expansion and contraction of boiler. The pump is bolted to the horn plates entirely clear of the boiler barrel, and a rivetted fixing is attached to the barrel to receive the inlet from the pump; thus the whole can be removed without disturbing the lagging.

For Prices see Page 26 of this List

PATENT PORTABLE STEAM ENGINE

WITH TWO CYLINDERS—14 TO 40-H.P.

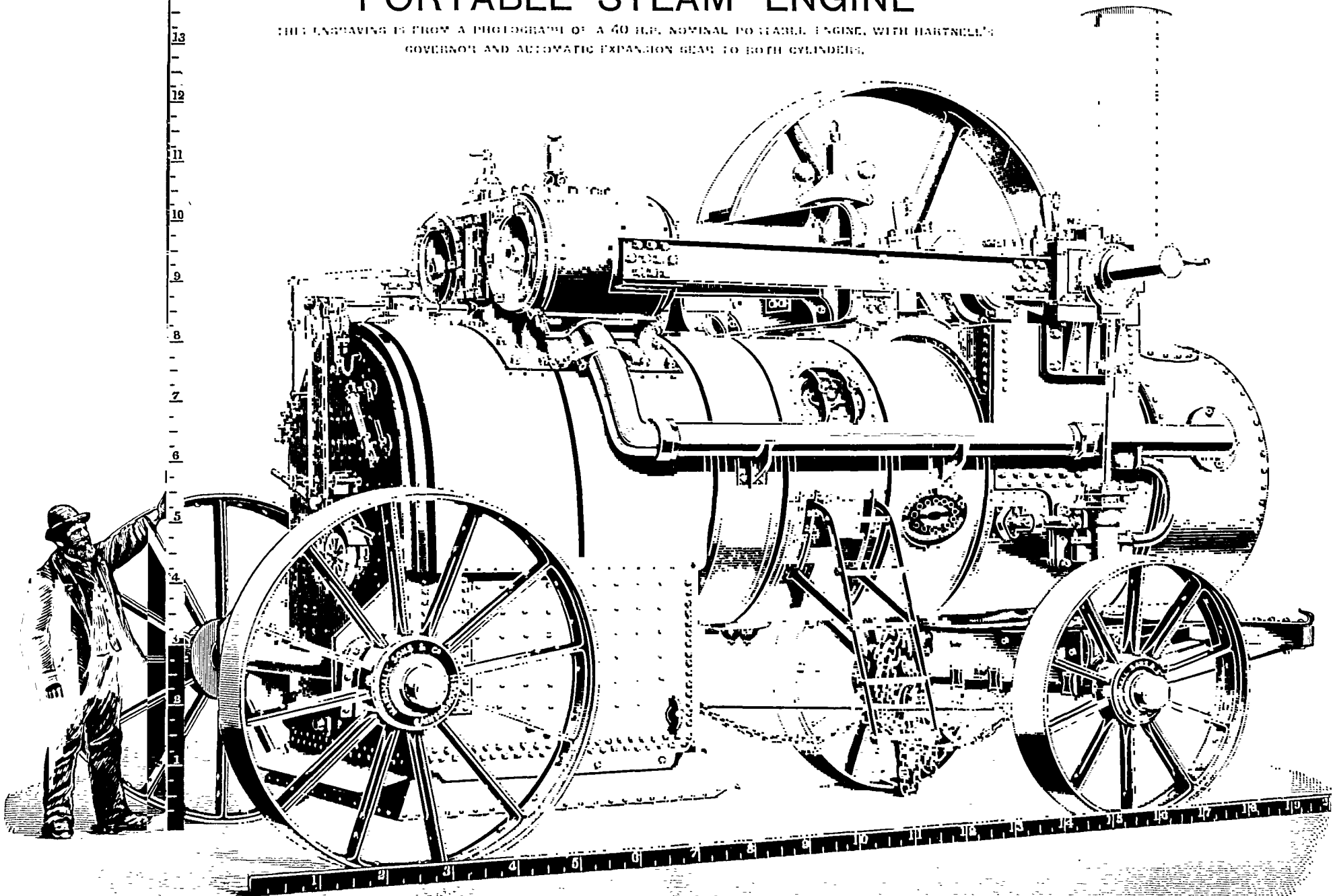


Above we illustrate our **Patent Portable Engine,** from which it will be seen the Boiler is flush throughout and is lagged and cased the whole length; the Cylinders have a flange all round the base (which admits of their being secured in their place in the stiffest manner possible), strong lugs are cast on the front end of the Cylinders, to which are attached wrought-iron stays for connecting it to the carriages of the Crank-shaft; thus both the Cylinders and Crank-shaft are rigidly maintained in their respective positions, and the strain on the Boiler by the working of the Engine is reduced to a minimum—further, the Boiler is quite free to expand and contract without affecting the positions of the Cylinders and Crank-shaft. A wrought-iron bridge-plate is provided for receiving the governors, one end of the cross head guide and the valve rods, and is supported by the stays above mentioned. By this arrangement the bolt connections to the Boiler are confined to the Cylinders, the Force Pump being attached to one of the horn plates. We have for more than twenty years past built all Portable Engines of 14 Horse-power and upwards on our **Patent Principle,** and they have met with general favour, having given most satisfactory results in working.

For Prices see page 26 of this List

PORTABLE STEAM ENGINE

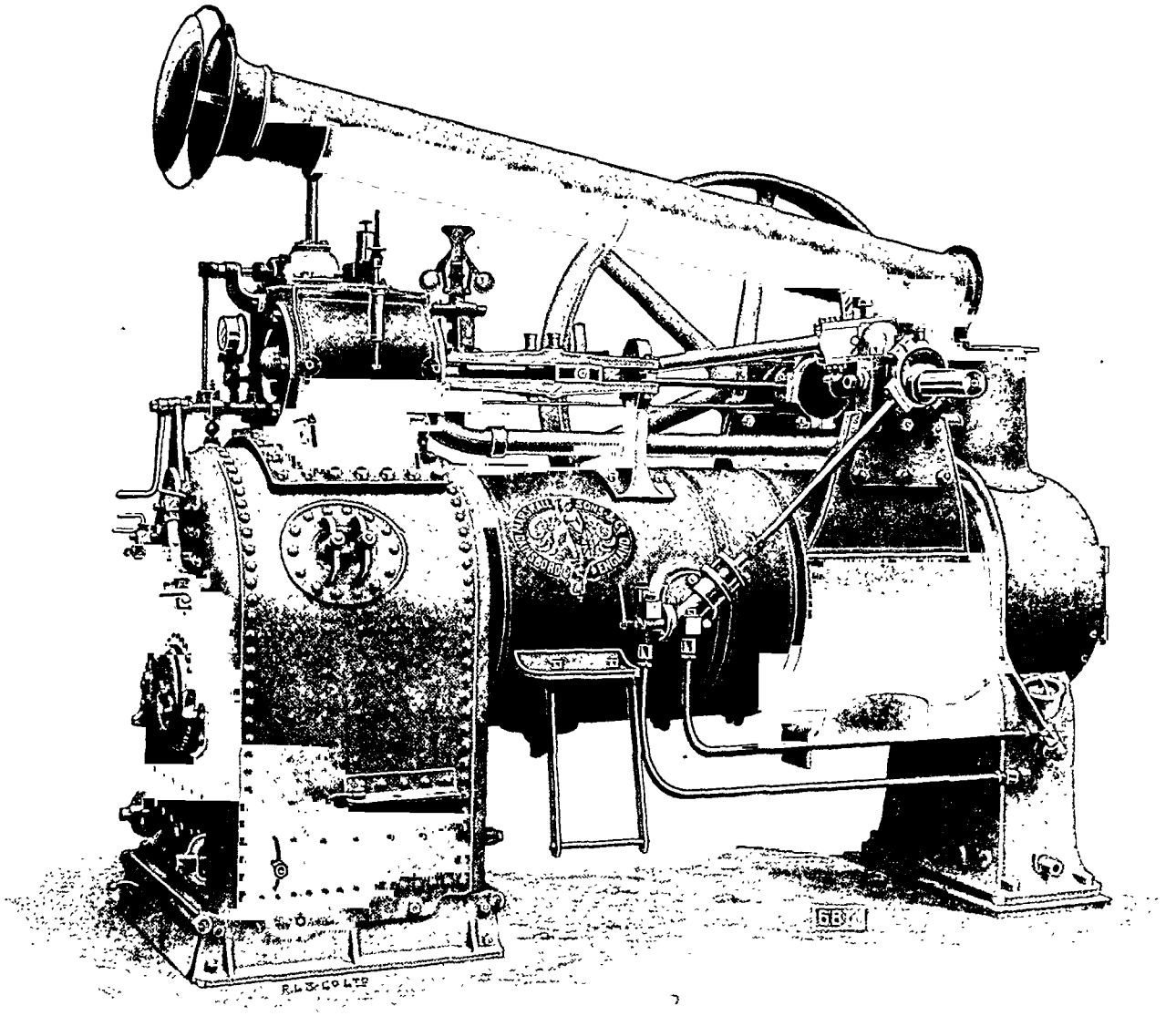
THIS ENGRAVING IS FROM A PHOTOGRAPH OF A 40 H.P. NOMINAL PORTABLE ENGINE, WITH HARTNELL'S GOVERNOR AND AUTOMATIC EXPANSION GEAR TO BOTH CYLINDERS.



NEW PATTERN

SEMI-PORTABLE STEAM ENGINES

OVERHEAD TYPE



These Engines are precisely of the same construction as our Portable Engines, described on pages 2 to 5 up to 12 H.P. inclusive; above that power they are constructed in the same manner as the Patent Portable Engines described on pages 6 and 7, and are adapted for being fixed down by the substitution of a cast-iron Ash-pan and Feed Water Cistern in place of Travelling Wheels. In the Cistern under the Smoke-box a **Copper Coil** is arranged through which the exhaust steam passes—this heats the feed water to a high temperature without allowing it to come into direct contact with the exhaust steam—this arrangement besides promoting economy in fuel, prevents the oil and grease from the Engine mingling with the feed water and being pumped into the Boiler, which has a very injurious effect on the Boiler-plates with certain kinds of feed-water.

Being fitted with axle lugs and turn-plate they can readily be converted into Portable Engines either temporarily or permanently by attaching suitable wheels and axles.

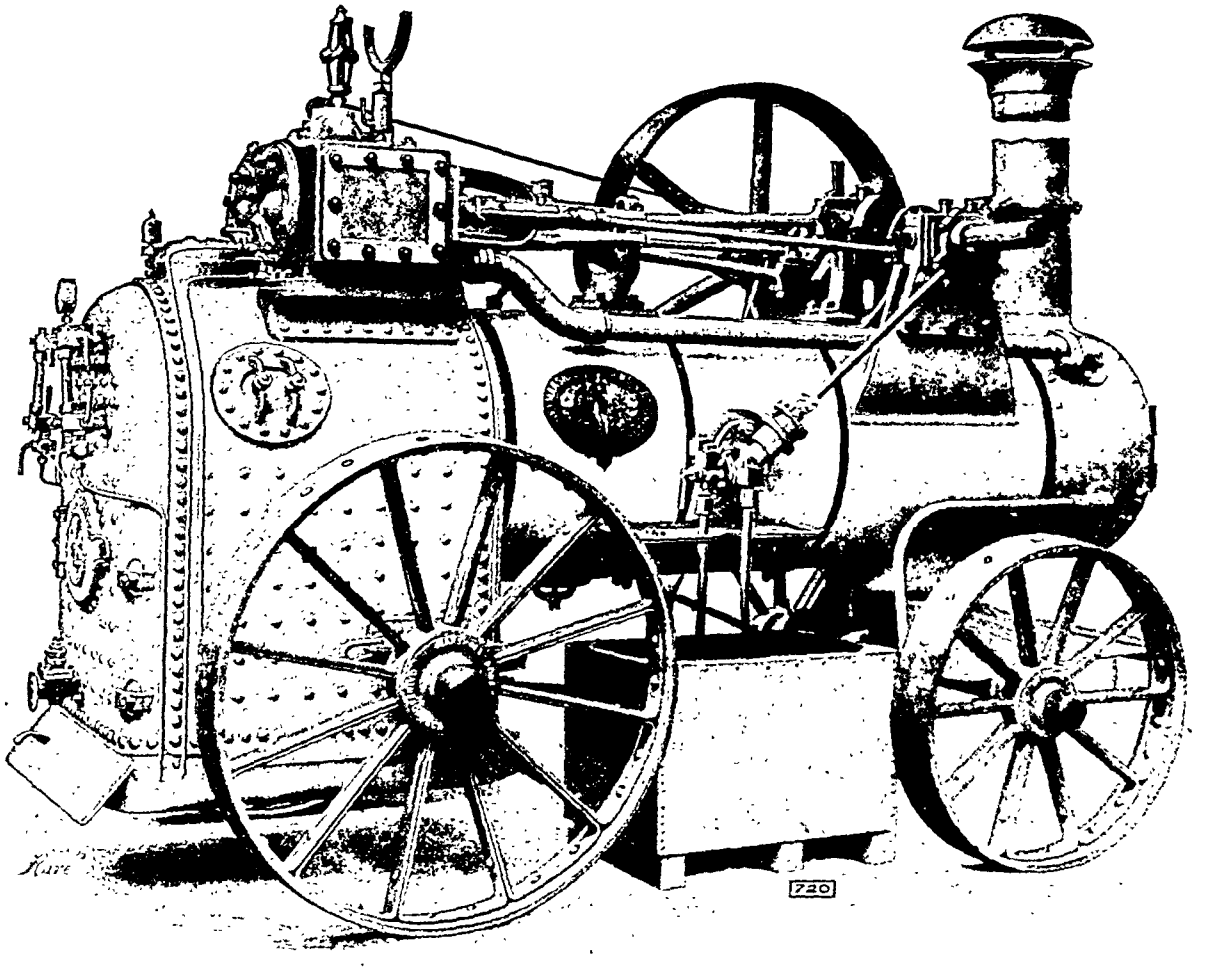
For Prices see Page 26 of this List

NEW TYPE

COMPOUND PORTABLE ENGINES

FITTED WITH

OUR IMPROVED CROSS ARM, OR THE PICKERING GOVERNOR AND EQUILIBRIUM THROTTLE VALVE, OR HARTNELL'S PATENT GOVERNOR AND AUTOMATIC EXPANSION GEAR TO HIGH-PRESSURE CYLINDER



These Engines are made from **8** to **20** Nominal Horse Power, as described on page 11.

The above Illustration is from a Photograph of our **10** HP. size, fitted with the Pickering Governor and Throttle Valve.

NEW TYPE COMPOUND

PORTABLE & SEMI-PORTABLE ENGINES

The illustration on page 10 represents our new type **Patent Compound Portable Steam Engine,** specially designed to give the utmost economy that can be obtained in an Engine of the Portable type. They are constructed to work at **140 lbs.** steam pressure, and will give off three times their nominal power when running at our standard speeds.

The following are some of the principal improvements introduced in this new design of Compound Engines:—

The **Cylinders** are mounted on planed Steel Girders, rivetted on shell of Boiler, planed on upper face, and the bottom of Cylinders is planed to fit on the Girders, so the bolts connecting Cylinders to Girders are arranged outside the Boiler.

There is a copper connection on a separate rivetted fixing to convey steam to the Cylinder. This connection is covered with non-conducting composition, the whole being enclosed in a neat casing so as to avoid all condensation; the steam is taken up round the Cylinder and in at the top and this ensures its entering the Cylinder in its driest possible condition. Both the slide-valve chests are outside the Cylinders and all valves are readily accessible.

There is a separate drain pipe from the cylinder jackets to the boiler at the end next to the crank-shaft, so that there is no possibility of any condensation from the jacket mixing with the steam passing into the Engine. In order to ensure the greatest possible stiffness in the crank-shaft and steadiness in running, the crank-shaft is provided with a central bearing. The outside bearings are on steel horn plates, and the central bearing is attached to a planed fixing projecting above the lagging rivetted to the boiler. The safety valves (2) are bolted to a W.I. fixing, also rivetted to boiler.

The **Pump** is of the diagonal type, perfectly self-contained, having no troublesome pipe connections, bolted to a steel fixing rivetted to the boiler. There are no bolts into the steam or water space of the boiler in any part.

With the **Compound Portable Engines** we include a Galvanized Iron Tank, containing copper coil, as shown in the illustration on opposite page, for heating the feed-water without allowing it to come in direct contact with the exhaust steam.

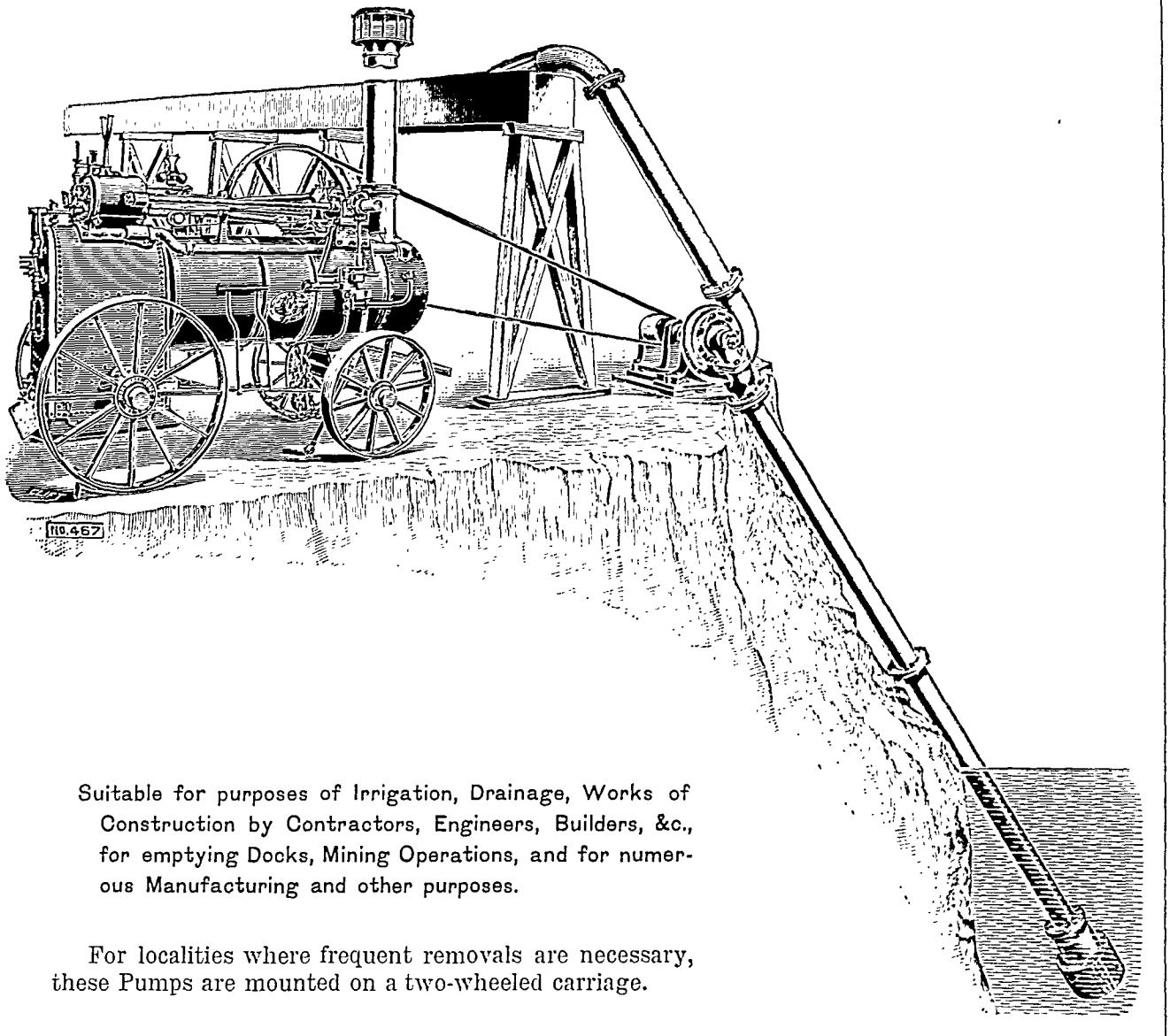
The **Compound Semi-Portable Engines** are of precisely the same type as the Portables, but instead of being equipped with travelling wheels and undergear, are mounted on a strong cast-iron frame, forming an ash-pit at fire-box end and a cistern under the smoke-box in which a copper coil is arranged, through which the exhaust steam passes—this heats the feed water to a high temperature without allowing it to come into direct contact with the exhaust steam—this arrangement, besides promoting economy in fuel, prevents the oil and grease from the engine mingling with the feed water and being pumped into the boiler, which has a very injurious effect on the boiler plates with certain kinds of feed water.

These Engines are largely adopted where the motive power is not likely to be transported from place to place.

The Engines of 8 to 12 H.P. are mounted on boilers with raised fire-box, as shown on opposite page, but the 16 H.P. and 20 H.P. sizes are on flush top boilers, as described on page 7.

For Prices see page 26 of this List

PORTABLE STEAM ENGINE AND PATENT CENTRIFUGAL PUMP



Suitable for purposes of Irrigation, Drainage, Works of Construction by Contractors, Engineers, Builders, &c., for emptying Docks, Mining Operations, and for numerous Manufacturing and other purposes.

For localities where frequent removals are necessary, these Pumps are mounted on a two-wheeled carriage.

For Prices of Engines see Page 26

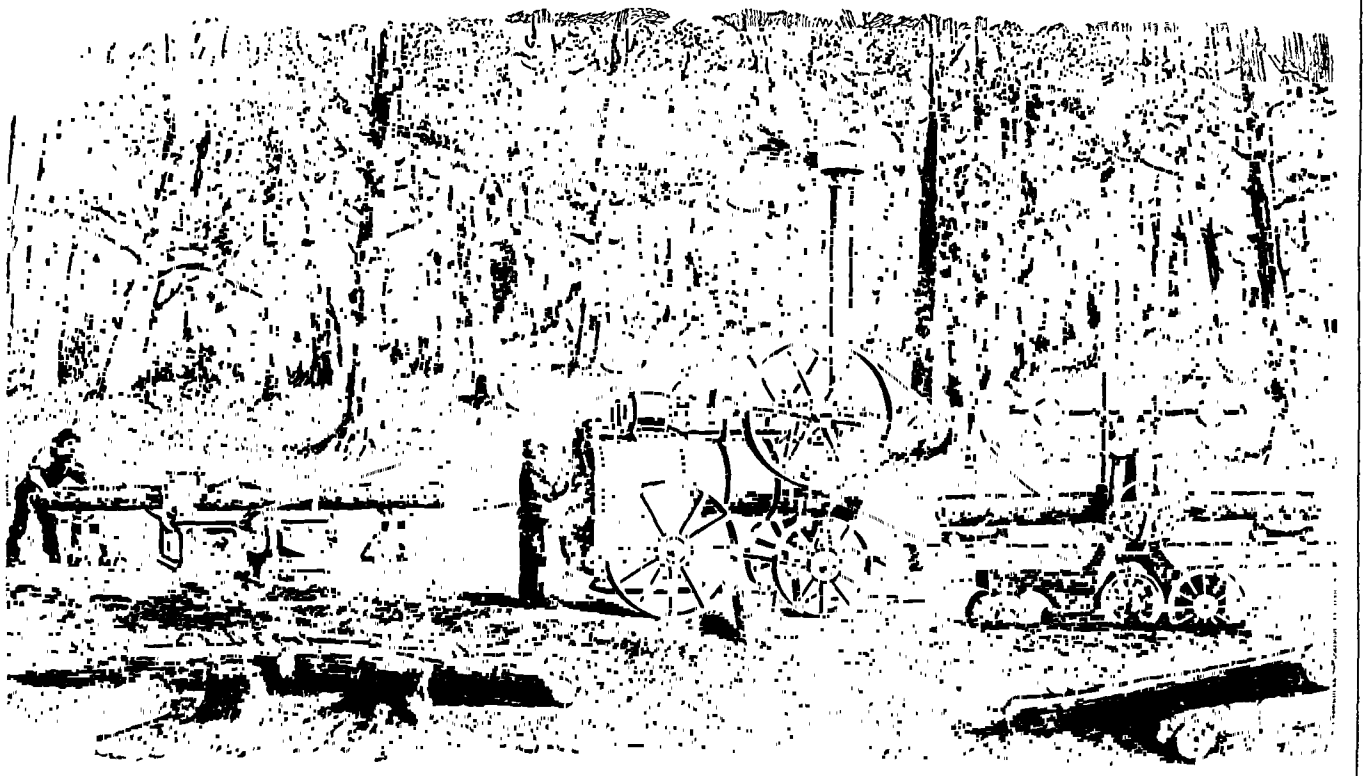
Prices of Centrifugal Pumps on application.

NOTE.—In ordering Centrifugal Pumps the distance from the lowest level of the water to the ground line and from the ground line to the top of the delivery bend should be given, not only to enable us to send the requisite length of piping, but also to determine the size of Engine necessary for the work.

PORTABLE ENGINE

TIMBER FRAME AND CIRCULAR SAW BENCH

Shown in position cutting up Timber at the place of its growth.



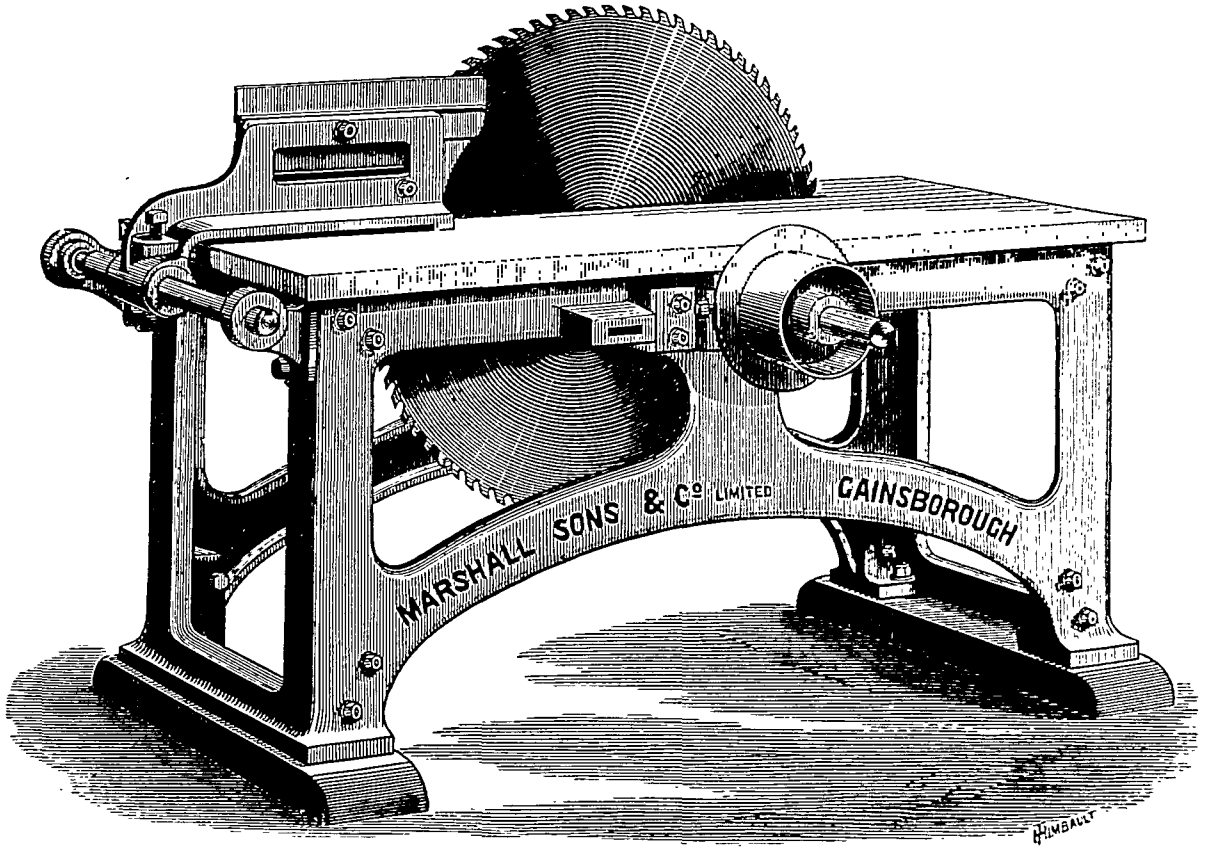
This plan of converting Timber is found to be highly advantageous both in this country and abroad, as each part is self-contained and portable, and is very readily fixed in position. The Sawing Machines are driven direct from the Engine by Belts from two separate Fly-Wheels, and the Engine being constructed with extra large Fire-box to burn Wood, Chips and Sawdust, fuel is obtained free of cost.

We recommend for this work Engines with 2 cylinders of 10 Horse Power and upwards, according to size of Timber, but if only one machine is required to be worked at a time, an Engine of 8 or 10 Horse Power will suffice for ordinary purposes.

For particulars of Engines see pages 2 to 11, and of Circular Saw Benches pages 14 to 20. The prices of Timber Frames vary according to their capabilities and range from £250 to £400.

We shall be pleased to send exact Estimates to intending purchasers on receiving information of their requirements.

CIRCULAR SAW BENCHES

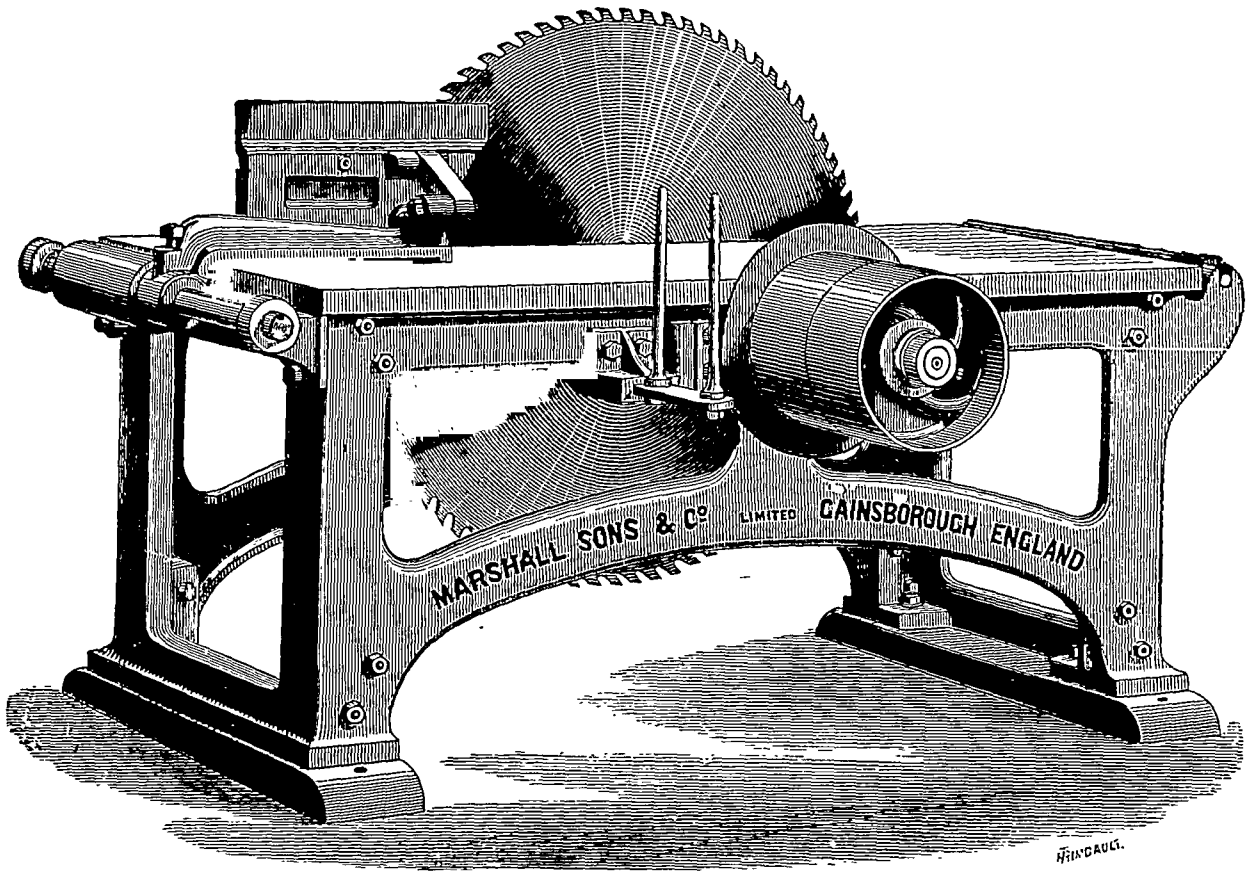


No. 1 SAW BENCH

Table 4 ft. 4 in. long, by 2 ft. 2 in. broad, capable of taking in any size of Saw up to 30 in. diameter, fitted with Fast Driving Pulley, 8 in. diameter, 4¼ in. wide (which should revolve at a speed of 900 revolutions per minute), and Parallel Saw Fence.

We give herein a series of Illustrations of our Saw Benches, embodying important improvements in equipment, and as will readily be seen, they are of very massive construction. We have done a large business in Saw Benches for many years, and our lengthened experience in this branch has been brought to bear in thoroughly perfecting these Benches in every detail. Although not cast in one piece with the top, they will be found equally rigid in work, the sides and ends of the frame with the top being of the most substantial character, with ample joint surfaces, all planed and well secured together.

They are especially adapted for export on account of the small compass in which they can be packed, the sides, ends, and top can quickly be separated and the fittings detached, and owing to the small number of the parts and simplicity of arrangement, they can as readily be put together again at destination. This is an important advantage when sending Saw Benches to distant countries at high rates of freight.



No. 2 SAW BENCH

Table 5 ft. long, 2 ft. 8 in. broad, capable of taking in any size of Saw up to 36 in. diameter, fitted with Fast and Loose Pulleys, 10 in. diameter, 6 in. wide, (which should revolve at a speed of 800 revolutions per minute) Strap Throwing-Off Gear, and Diagonal Motion to Saw Fence.

The Benches illustrated on pages 14 and 15 are arranged for being driven direct from Portable or Vertical Engines by means of an endless driving belt. In cases where they are required for fixing down in Saw Mills and are driven from a line of shafting, we construct them with a Bracket and outside Bearing, the driving pulleys being between the latter and the table, as shown on page 16. The outside Bearing brackets are supplied at the extra charge given in the Price List.

The **Frames** are of Iron, extra strong, with **Planed Iron Tables.**

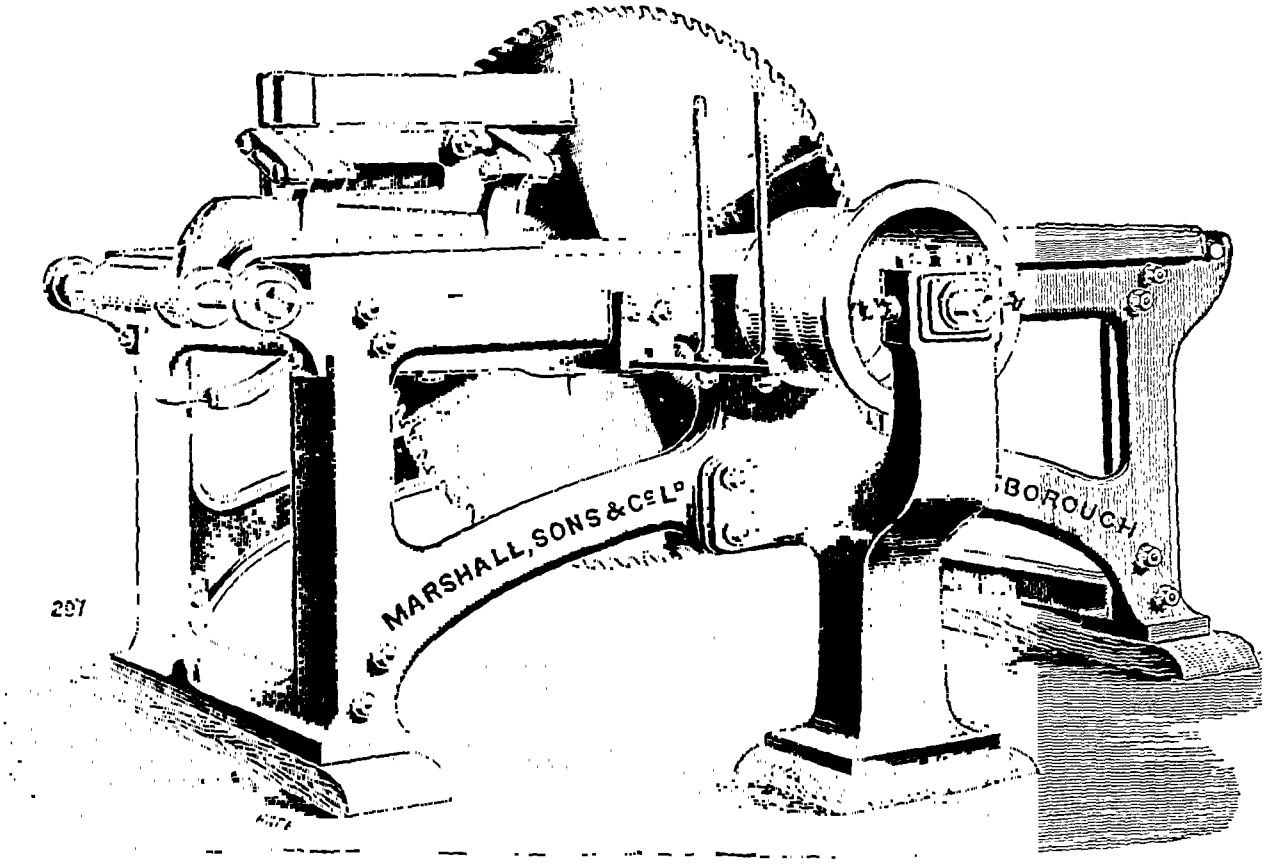
The **Circular Saws** are the best machine ground, and are efficiently steadied in the Table.

The **Saw Spindles** run in extra long Brass Conical Bearings, with adjustable carriages.

The **Driving Pulleys** are of suitable size and width to be driven direct from the Fly-wheel of the Engine if required.

The **Saw Fences** slide on a strong turned bar at the end of Table, and are arranged to turn over off the Table for cross-cutting; they can be adjusted with the greatest accuracy to a scale marked on the Table, and they have slide plates fitted on face to adapt them to saws of various sizes.

Iron Rollers are fixed at the end of Nos. 2 and 3 Tables to facilitate the moving of the timber.



No. 3 SAW BENCH

SHOWING OUTER-BEARING AND BRACKET ATTACHED

Table 6 ft. long, 3 ft. broad, capable of taking in any size of Saw up to 42 in. diameter.
Driving Pulleys 12 in. diameter, 6 in. wide, speed 700 to 750 revolutions per minute.

THE WHOLE OR ANY PORTION OF THE FOLLOWING APPLIANCES CAN BE FITTED TO Nos. 1, 2 and 3 BENCHES WHEN REQUIRED:—

Diagonal Motion attached to the Parallel Fences for Feather-edge Cutting.

Loose Pulley and Strap Throwing-off Gear, with lever under handy control.

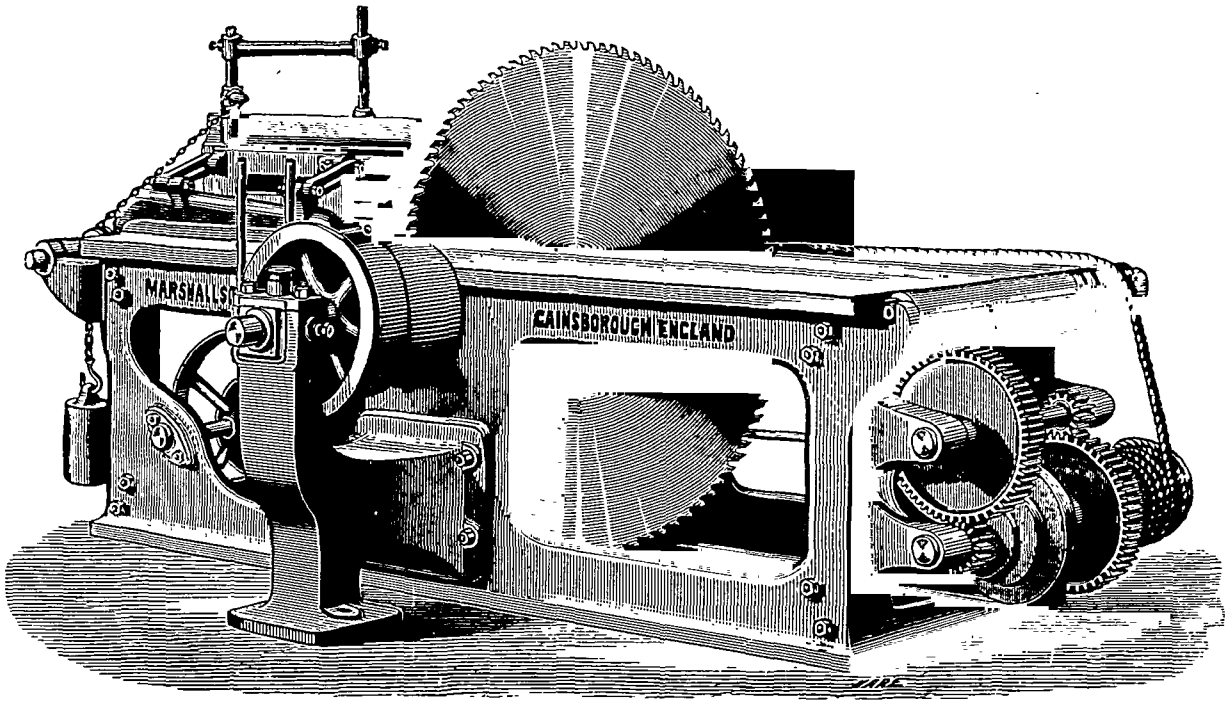
Boring Apparatus, with four Patent Boring Bits, conveniently arranged at opposite end of Spindle to Driving Pulleys.

Boring Table, consisting of a turned column, adjustable vertically and with the upper part T shaped, and formed to receive a slide, by means of which a movement is obtained for the boring table in a true line with the boring nut. This Table is regulated by a hand-wheel and screw to any required distance from centre of Bit.

SELF-ACTING

CIRCULAR SAW BENCHES

Nos. 4 and 5



These Benches are on the same principle as those described on preceding pages, but of stronger construction throughout; they are made of two sizes as hereinafter detailed, and are fitted with **Self-Acting Feed Motion** for drawing the Timber up to the Saw at speeds varying from 10 to 60 feet per minute. They are also provided with Fast and Loose Pulleys, Strap Throwing-off Gear, and an Improved Saw Fence arranged to turn over off the Table for cross-cutting, and embodying a Sliding Plate to adapt them to Saws of various sizes, diagonal motion for Feather-edge Cutting, and a Spring Roller to insure accuracy when sawing Deals, all these items being included in the list price.

We supply Benches of this type, either with a strong Bracket firmly bolted to the side and also arranged for being secured to the floor, with an Adjustable Bearing in the upper part to support the outer end of Saw Spindle as illustrated above,—or (in the No. 4 size) with the Driving Pulleys outside the Bearing (see illustration on page 15,) as may be preferred.

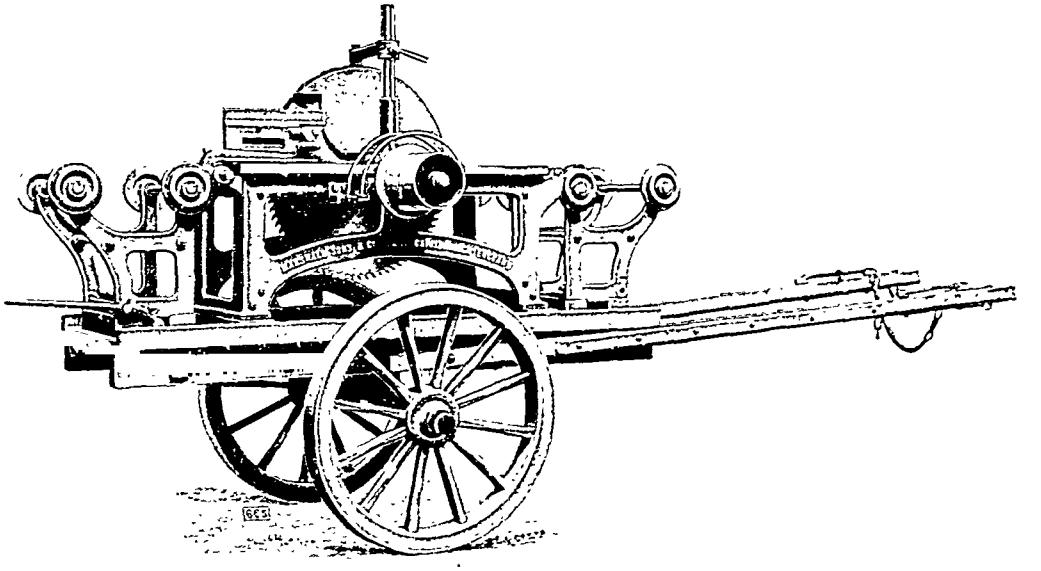
No. 4.—Table 6 ft. long, by 3 ft. broad, fitted with 36 in. Saw, but capable of taking in any size of Saw up to 42 in. diameter. Driving Pulleys 12 in. diameter, 6 in. wide, speed 700 to 750 revolutions per minute.

No. 5.—Table 8 ft. long, by 3 ft. broad, fitted with 42 in. Saw, but capable of taking in any size of Saw up to 48 in. diameter, Driving Pulleys 14 in. diameter, 6 in. wide, speed 650 revolutions per minute.

The No. 4 and No. 5 can also be supplied as plain Benches if required (that is, without the Self-acting Gear) at the reduction named in our Price List.

For Prices, including one Saw, see page 27 of this List

PORTABLE CIRCULAR SAW BENCHES



Mounted on a suitable Frame, with Axle, two Wood Wheels and pair of Shafts for convenience in transit when frequent removal from place to place is necessary.

We can also mount them on four smaller Wrought-iron Travelling Wheels if preferred.

Prices and Particulars on Application

SAW SPINDLES AND CARRIAGES

SUITABLE FOR ATTACHMENT TO WOOD FRAMES

These consist of a pair of strong Cast-iron Carriages connected together, suitably arranged for bolting to a Wood Frame. The Carriages are fitted with gun-metal bearings for supporting the spindle, the latter being provided with fast and loose driving pulleys. These Spindles are made in different sizes, to carry Saws ranging from 24 in. to 48 in. diameter.

Prices and Particulars on Application

GUARD FOR CIRCULAR SAWS

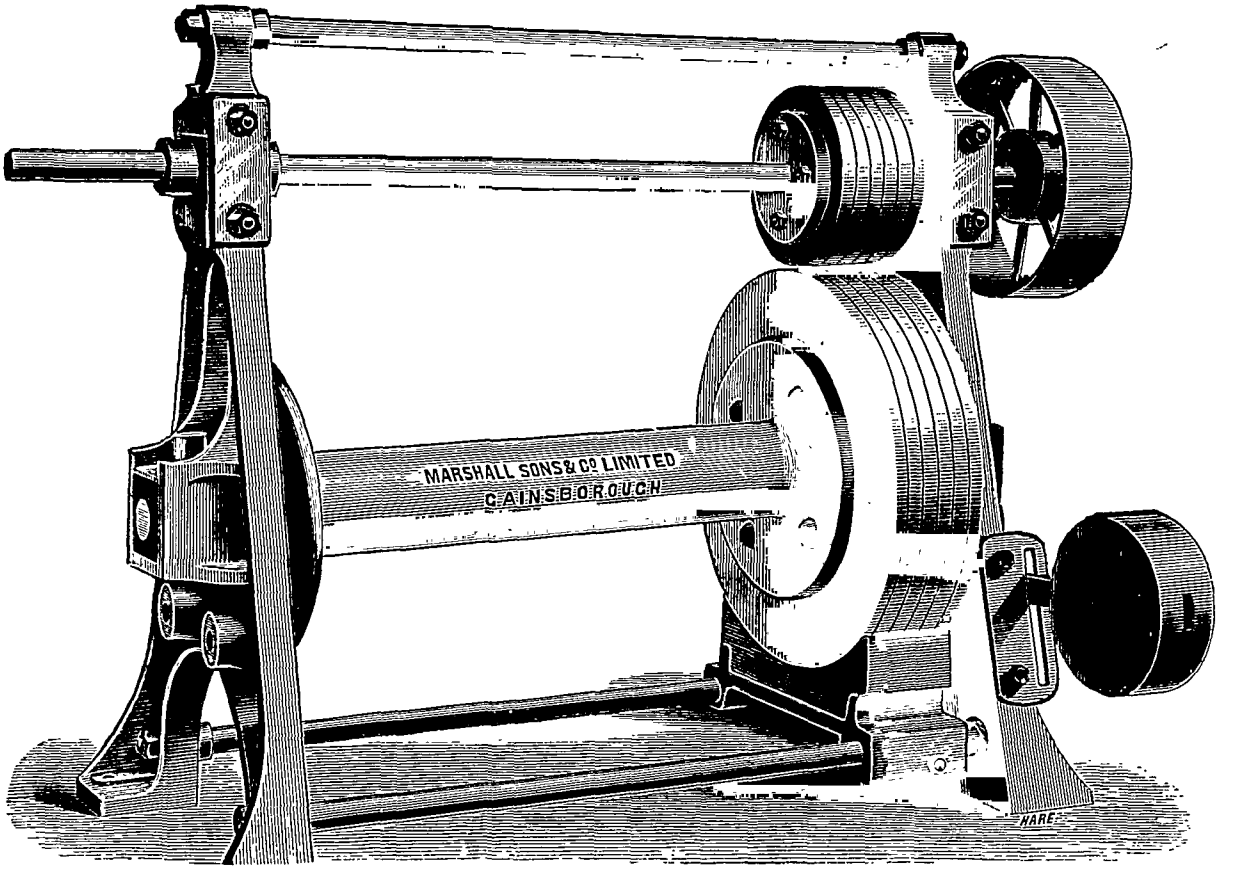
To meet the demand of a number of our customers and the requirements of H.M. Inspectors of Factories, we can supply a simple and efficient Saw Guard, as shown in the above illustration, No. 665, which, whilst it does not impede the work, will give the necessary protection to the workmen; this guard can be fitted to any of our new or existing benches.

For Prices see page 27 of this List

MARSHALLS'

IMPROVED FRICTON HOIST

SUITABLE FOR BUILDERS, CONTRACTORS AND OTHERS.



The above Friction Hoist can readily be driven from a Portable Engine by means of a belt.

It is very quick and can hoist from **80** to **100** barrow loads per hour, from **80** to **100** feet high.

These Hoists are fitted with an improved and durable friction gear, but the wearing surfaces can readily be renewed by any ordinary mechanic when required.

The Brake is capable of holding the load at any height with perfect safety.

The Hoist is perfectly under the control of the man at the top of the building, who by means of a cord can hoist the material and receive same at top, thus saving a man's labour at the hoist, as there are no double belts to require a man to attend to them below.

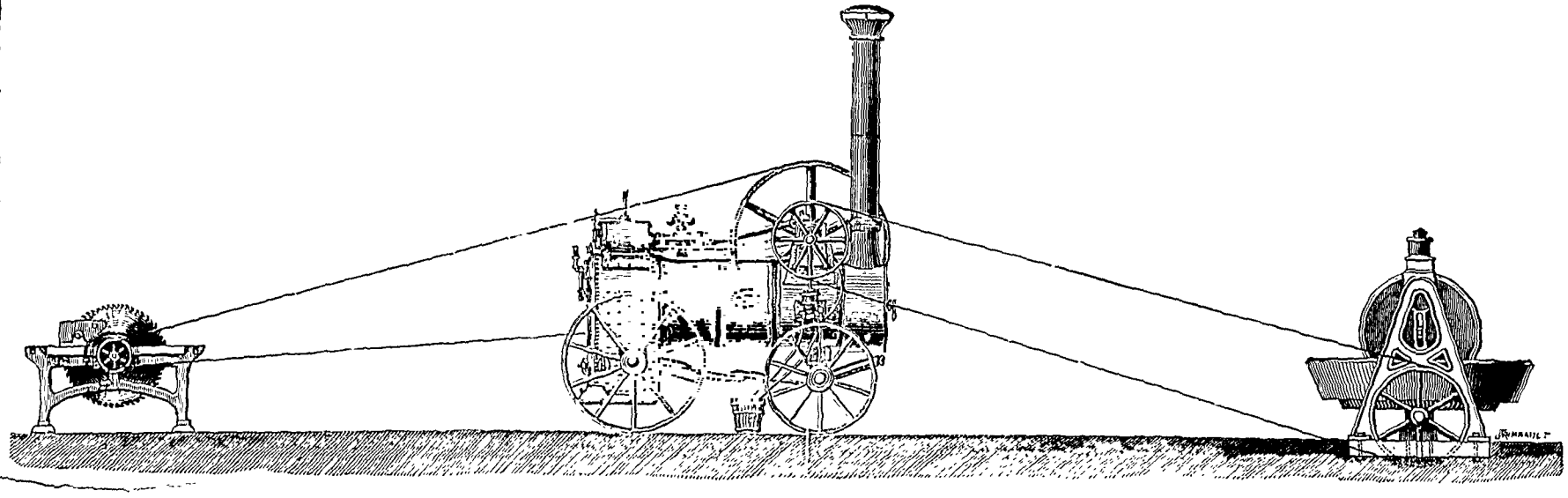
Chains any length for these hoists can be supplied to order.

The Pulley for driving can be used on either side at pleasure, and is readily interchangeable. Unless otherwise ordered the Pulley is supplied 15″ diameter and 5″ face for a speed of 250 revolutions per minute, and the hoist is then suitable for weights of 5 to 7 cwts. maximum. If it is required to lift weights up to 10 cwts. maximum, the friction gear can be widened, and the driving pulley made suitable for a 6″ Belt at a slight extra cost.

For Prices see Page 27 of this List

PORTABLE ENGINE

DRIVING MORTAR MILL AND CIRCULAR SAW BENCH



The above illustration shows a Portable Engine working a Mortar Mill and a Circular Saw Bench, the latter being driven from the Engine Fly-wheel and the Mortar Mill from a Pulley fixed to opposite end of Crank-shaft. The machines may be worked either both at one time or separately as desired.

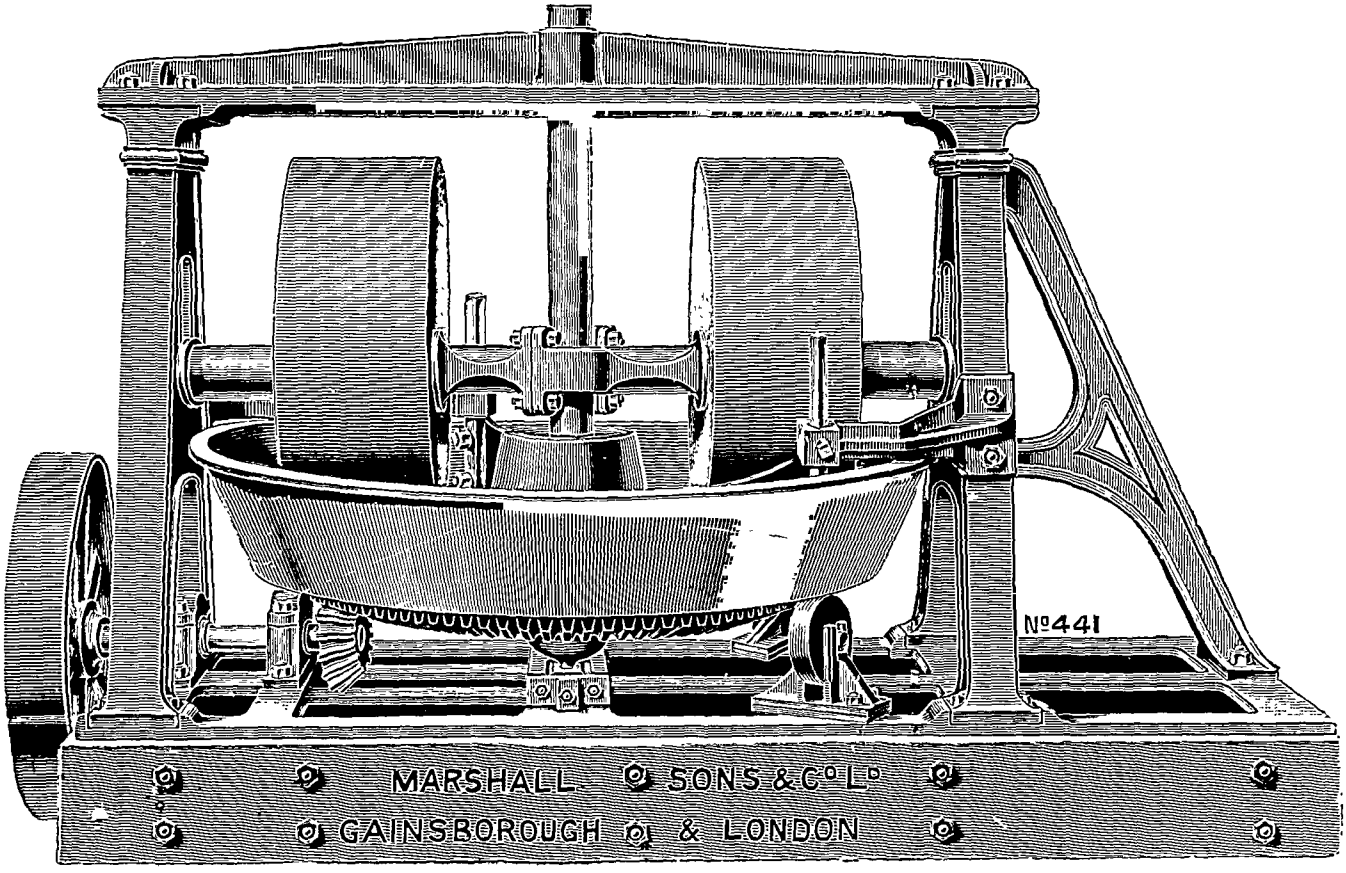
An arrangement of this kind is often of the greatest advantage to Contractors, Builders, and others; and the Engine, when not wanted for the work named, may be readily applied to Pumping, or to any other purpose to which Steam Power is applicable.

For full particulars of Portable Engines see pages 2 to 11. Circular Saw Benches pages 13 to 20; Mortar Mills page 21; and for present prices of same please refer to pages 26 and 27 of this List.

MORTAR MILLS

These Mills are constructed on the most approved principle for efficiently grinding up old Brick Rubbish, Broken Stone, &c., with the least power possible. They are designed so as to be easily taken to pieces for removal and refixing.

Each Mill is fitted with a strong strut to keep the frame firmly in position, flush sided runners and set of false bottoms, made from a special hard mixture of iron to insure durability, adjustable Scrapers, Driving Shaft, Pulley, Steel Toe-piece with centre shaft. (Special arrangement is made for changing the toe-piece with ease when worn.) The whole substantially made and fitted on an iron foundation plate ready for fixing on timber frame.



TIMBER FRAME NOT INCLUDED

PAN		RUNNERS		PULLEY		Approximate Total Weight of Mill.
Diameter at the Top.	Revolutions per Minute.	Size in Inches.	Approximate Weight of each.	Size in Inches.	Revolutions per Minute.	
ft. in.		in. in.	Cwts.	in. in.		Cwts.
5 0	26	30 × 11	10	24 × 5	104	65
5 6	26	32 × 12	12	24 × 5	104	72
6 0	24	36 × 13	15	30 × 6	96	85
6 6	24	36 × 14	17	30 × 6	120	95
7 0	20	39 × 15	20	36 × 6	100	110
7 6	20	39 × 16	22	36 × 6	100	120
8 0	18	42 × 17	26	42 × 6	90	150
9 0	18	42 × 18	30	42 × 6	90	170

For Prices see Page 27 of this List

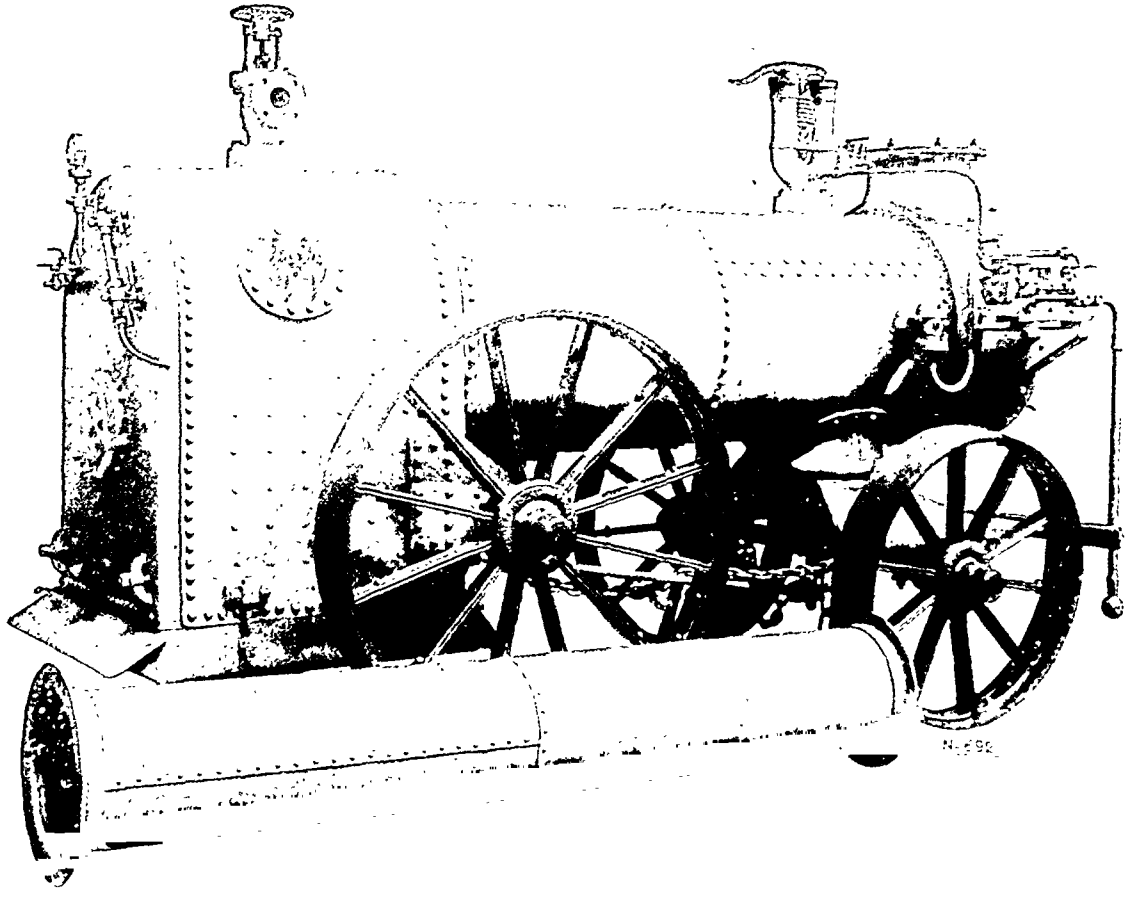
Mills 7 ft. and upwards should have friction Rollers. Heavier Runners can be put in Mills for special purposes at an extra cost. When the Runners are worn thin on face they should be hooped. Hoops and duplicate parts can always be supplied from stock.

PORTABLE

LOCOMOTIVE MULTITUBULAR BOILERS

AS MADE FROM 2 TO 12 H.P. INCLUSIVE

(Illustration from Photograph of 10 H.P. size)



For many years we have made the manufacture of Locomotive Boilers a speciality, and we have one of the largest and most complete plants in this country for their production, replete with all the most modern machine tools and appliances for turning out the best possible work in this branch.

The use of Locomotive Boilers has largely increased during the last few years, as they are very economical in fuel, and can be fixed down on a strong Cast Iron Ashpan at the Fire-box end and a substantial Pedestal under the smoke-box; thus dispensing with brickwork setting, or they can be mounted on Travelling Wheels and Undergear, as shown above, and be moved from place to place for temporary work, being entirely self-contained.

The Illustrations on this and following page represent our standard type of **Portable Locomotive Boilers** as constructed for **100 lbs.** working pressure. They are made throughout of Siemens-Martin mild Steel of special quality; the longitudinal seams in the barrel are double rivetted and the edges of the plates planed, and the rivetting and flanging done by special machinery.

The **Fire-box** can be arranged to burn Coal or Coke, but where Wood fuel or inferior fuel is to be used we recommend our extra large or Colonial sized Fire-box, which can be supplied at a slight extra charge. We give ample water space between the Fire-box and the Shell, and in boilers of 14 H.P. and upwards we put solid foundation rings.

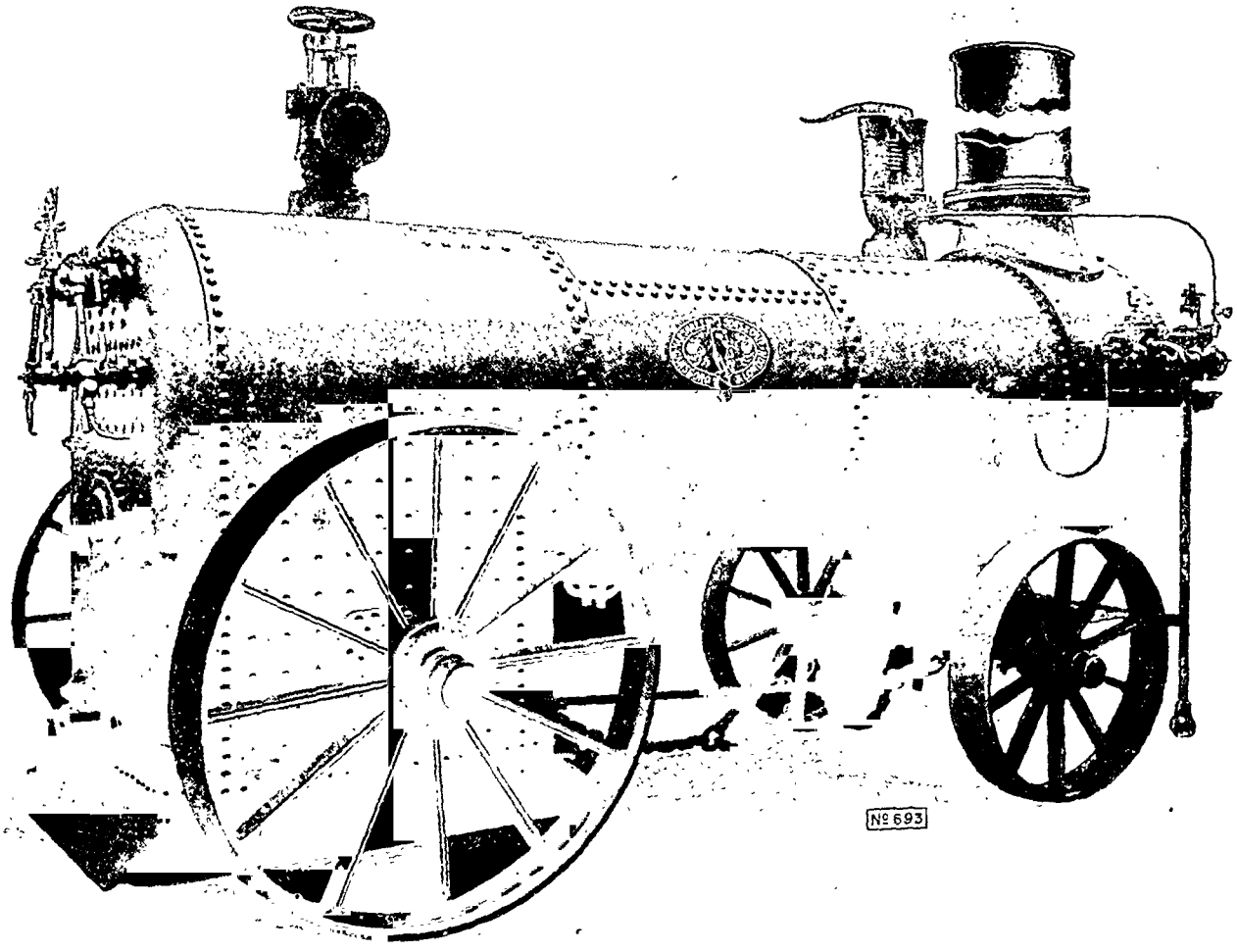
(CONTINUED ON NEXT PAGE)

PORTABLE
LOCOMOTIVE MULTITUBULAR BOILER

FLUSH TOP TYPE

AS MADE FROM 14 H.P. UPWARDS

(Illustration from Photograph of 25 H.P. Size.)



(CONTINUED FROM PREVIOUS PAGE.)

The **Manhole** is placed in such a position as to give ready access to the top of the Fire-box, and the **Mudholes** are so arranged that all sides of the Fire-box can readily be got at for cleaning.

Fittings :—Each Boiler is provided with a complete equipment as shown, including stop and safety valves, steam and water gauges, blow-off cock and feed check valve. The stop and safety valves are bolted to separate wrought-iron blocks strongly rivetted to the Boiler Shell, and as these blocks are of the same size, the positions of these two valves can be changed to suit circumstances, which is an important advantage, especially in Boilers used for temporary work.

The Portable Boilers are provided with an efficient donkey feed pump, as shown on pages 22 and 23, and also with a suitable length of W.I. chimney, and they are mounted on strong wrought-iron travelling wheels, with steel plate fore-carriage, which are practically indestructible.

Full Particulars, with Prices for Sale or Hire, on Application

The above Illustration represents an external view of our London Branch, where we have Offices, large Show-rooms and Stores for our Engines and other Machinery, a Repair Shop, and a staff of competent workmen. In connection with this Depôt we also carry on an extensive business in the **letting out on hire** of Portable and other Engines suitable for use in case of breakdowns, and for all kinds of temporary work, Electric Lighting, &c., Portable Loco Boilers, Saw Benches, Mortar Mills, Centrifugal Pumps, Barrow Hoists and other Machinery suitable for Contractors, Builders and others.

PORTABLE ENGINES

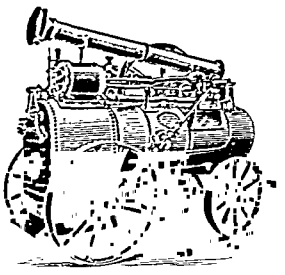
AND PORTABLE BOILERS, &c.

FOR SALE OR HIRE

IN case you at any time require to hire or purchase, at short notice, Portable Engines, Locomotive Multitubular Boilers, &c., we take this opportunity of inviting your attention to the facilities offered at our London Depôt, as on opposite page, for the supply of such. We have always in stock there, ready for immediate delivery, an assortment of our Portable Engines, of powers varying from 6 nominal H.P. to 40 nominal H.P. as on pages 2 to 8 of this Catalogue. Locomotive Multitubular Boilers, of various sizes, mounted on travelling wheels, and fitted with feed pumps, as on pages 22 and 23; also Friction Hoists, as on page 19; Centrifugal Pumps, &c., and we should be pleased to receive your valued enquiries either by telegram or letter, when they shall receive our immediate and careful attention.

The Engines and Boilers we supply on hire are always either new or nearly so, and of our most modern and improved construction in every detail, and suitable for a working pressure of from 90 to 100 lbs. per square inch. They are thus quite superior to the class of Machinery usually let on hire, and effect a great diminution, compared with such, in the fuel consumed in proportion to the power developed, in addition to which, with ordinary treatment, there is no liability to breakdown, as is the case where old Machinery is employed.

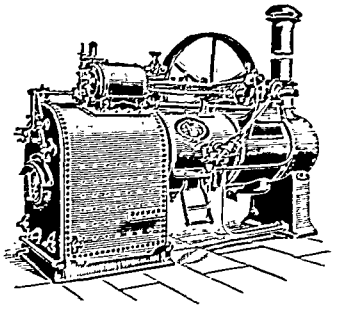
We have also always on exhibition, in our front Showroom there, a number of new Engines of different types, viz.: Horizontal Fixed Engines, Independent Vertical Engines, Compound Engines, separate or combined with Locomotive Multitubular Boilers, Traction Engines, and Circular Saw Benches. These are on sale, and can be sent out in execution of orders.



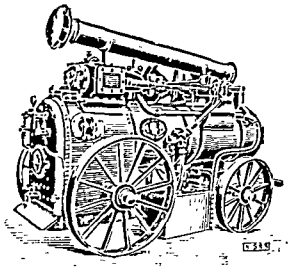
PORTABLE
AND
SEMI-PORTABLE ENGINES

For 100 lbs. working pressure

See Pages 2 to 9



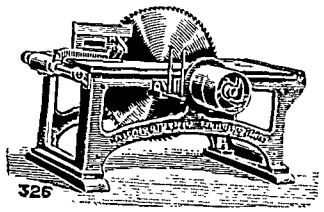
Nominal Horse Power	Prices: Portable	Code Words:	Prices: Semi-Portable	Code Words:	Link Motion Reversing Gear Code: DABBLED	Automatic Expansion Gear Code: DABSTER	Enlarged Fireboxes Colonial Size Code: EDLITZ	Injector Code: EDULIUM	Screw Brake to both Hind Wheels Code: DAGLISH	Packing in Skeleton Case for Short Distances	Packing in Closed Case for Export
Single Cylinder	Pages 2 to 5		Page 9				Page 7				
2	£110	CABAL	£106	CAINZO	£10	£5	£2	£6	£5	£1 5	£2
3	140	CABARET	135	CAIRNDOW	10	5	3	6	5	1 15	3
4	160	CABAROCK	150	CAJEPUT	10	6	4	6	5 10	2 10	4
5	180	CABARRAS	170	CALABRIA	12	7 10	5	7	5 10	2 15	5
6	195	CABBAGES	185	CALAFATO	12	9	6	7	5 10	3 0	6
7	210	CABELEAU	195	CALAGURE	15	10 10	7	7	6	3 5	7
8	225	CABELLOS	210	CALAMISTER	15	12	8	7	6	3 10	8
9	245	CABENDA	225	CALAMOCHA	15	13 10	9	7	6	4 0	9
10	260	CABEZON	245	CALAMUS	18	15	10	7	6	4 10	10
12	300	CABINETS	280	CALLAPPIO	18	18	12	7	6 10	5 0	12
Double Cylinder	Pages 6 to 8										
8	£255	CABOCHED	£240	CALANCAY	£20	£20	£8	£7	£6	£3 10	£8
9	270	CABOOSE	255	CALATRAVA	22	21	9	7	6	4 0	9
10	285	CABOTEUR	270	CALBUCO	25	22 10	10	7	6	4 10	10
12	330	CABRERA	310	CALCABAT	25	27	12	7	6 10	5 0	12
14	365	CABRON	345	CALCAGNO	30	31 10	14	8	6 10	6 0	13
16	405	CABRUTREE	385	CALCAVIT	30	36	16	8	7 10	7 0	14
20	485	CABULISTAN	460	CALCITRO	30	45	20	8	7 10	8 0	16
25	580	CACASODO	550	CALDBECK	35	56	25	10	10	9 0	18
30	690	CACATURA	660	CALDECOT	35	60	30	12	10 10	10 10	20
35	820	CACCAMO	790	CALDERARA	40	{ Included	35	12	12	11 0	22
40	915	CACKLING	885	CALEB	45	{ in Outfit	40	12	12	12 0	24



NEW TYPE
COMPOUND PORTABLE
AND
SEMI-PORTABLE ENGINES

FOR WORKING UP TO 140 lbs. PRESSURE. *See Pages 10 and 11*

Nom. Horse Power	Prices Including Feed Water Tank with Copper Coil: With Cross-Arm or Pickering Governor and Throttle Valve: Portable	Code Words:	Semi-Portable	Code Words:	With Hartnell Governor and Automatic Expansion Gear: Portable	Code Words:	Semi-Portable	Code Words:	Colonial Firebox Code: EDLITZ	Injector Code: EDULIUM	Screw Brake to both Hind Wheels. Code: DAGLISH	Packing in Skeleton Case for short Distances	Packing in closed Case for Export
			£		£		£						
8	320	CHAPPELL	300	CHATSWORTH	335	CHARIKAR	315	CHATWOOD	£8	£7	£6 0	£3 10	£8
10	340	CHAPRUNG	320	CHAUNCEY	365	CHARLIEU	345	CHAUVIN	10	7	6 0	4 10	10
12	375	CHARAGINA	345	CHAVONES	405	CHARMONE	375	CHEDDAR	12	7	6 10	5 0	12
16	450	CHARDSTOCK	420	CHEDDLETON	485	CHARVILLE	455	CHELMARSH	16	8	7 10	7 0	14
20	535	CHARICLO	505	CHELUNGA	570	CHATBURN	540	CHEMUNG	20	8	7 10	8 0	16

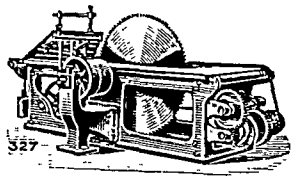

326

CIRCULAR SAW BENCHES,

WITHOUT SELF-ACTING GEAR

See Pages 13 to 16

		Code :—	No. 1. ICICLE With 24 in. Saw	No. 2. IDEALITY With 30 in. Saw	No. 3. IDENTIFY With 36 in. Saw
			£ s	£ s d	£ s
Bench, with Fast Pulley, Parallel Fence, and one Circular Saw	Code		18 10	23 10 0	40 0
Loose Pulley and throwing off Gear	Extra	IDIOTISM	1 10	1 15 0	2 0
Diagonal Motion to Fence	"	IDOLATRY	0 10	0 15 0	0 15
Boring Apparatus and 4 Patent Boring Bits...	"	IDOLIZED	1 10	1 10 0	1 10
Boring Table	"	IDYLLIC	3 0	3 10 0	4 0
Outer Bearing and Bracket in lieu of Inside Bearing ...	"	IGNOBLE	0 15	1 0 0	1 5
Extra Long Spindle with third Bearing and A Standard ...	"	IGNORANT	2 0	2 7 6	2 15
Packing in Closed Case for Shipment	"		1 5	1 10 0	2 0


327

SELF-ACTING CIRCULAR SAW BENCHES

See Page 17

			No. 4. Code : IDIOMS With 36in. Saw	No. 5. Code : IDIOPATHY With 42in. Saw
Bench complete with Bracket and outside Bearing as shown on page 17, including one Saw			£64 0 0	£81 0 0
Bench complete with overhanging Pulleys and inside Bearings, including one Saw			61 0 0	... ...
Boring Apparatus and 4 Patent Boring Bits	Code :— IDOLIZED ...	Extra	2 0 0	2 0 0
Boring Table	" IDYLLIC ...	"	4 0 0	4 10 0
Extra Long Spindle with third Bearing and A Standard	" IGNORANT ...	"	2 15 0	3 5 0
Packing for Shipment in Closed Case		"	2 10 0	3 0 0
Timber Rails and Trucks *See Page 13* ...	Code :— IGNESCENT ...	"	15 0 0	15 0 0

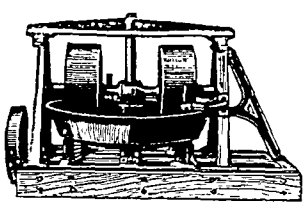
The No. 4 & 5 Benches can be supplied without Self-acting Gear, at a reduction of £20 from the above prices

Code:—IGNITING

PRICES OF CIRCULAR SAWS SET AND SHARPENED READY FOR USE.

24 in. £1 5s. 30 in. £1 17s. 6d. 36 in. £2 15s. 42 in. £4 5s. 48 in. £6 0s. each.

Code:—ILLEGIBLE ILLIBERAL ILLICIT ILLNATURED ILLOGICAL



PRICES OF PATENT BORING BITS Code:—ILLUMINATE

½ in. 5/ ¾ in. 6/ 1 in. 7/6 1¼ in. 8/6 1½ in. 9/6 each.

GUARDS FOR CIRCULAR SAWS. *See Page 18*

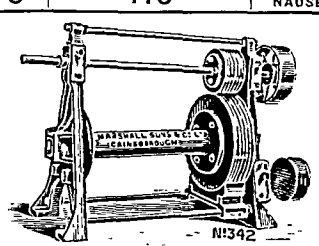
For 24 in. and 30 in. Saws, £2 10s. 36 in. £2 15s. 42 in. and 48 in. £3 0s.

MORTAR MILLS

See Pages 20 and 21

Pan Diameter at top	PRICE on Ordinary Foundation Plate	Code Words:	PRICE Mounted on Frame and Wheels with Lock and Shafts Code: NAVIGABLE	Extra for Friction Rollers Code: NEEDLESS	Extra for Box Foundation needing no Timber Frame Code: NAVIGATION	Extra for Steel Vertical Shaft Code: NAZARITE	Packing for Shipment
ft. in.							
5 0	£44	NAKED	£63	.....	£4 0 0	£1 13 0	£1 17 6
5 6	50	NARCISSUS	69	.....	4 0 0	1 15 0	1 17 6
6 0	55	NARRATOR	76	.....	4 10 0	1 18 0	2 2 6
6 6	61	NASCENT	84	.....	5 0 0	2 2 0	2 5 0
7 0	71	NATHLESS	95	£2 7 6	5 10 0	2 7 6	2 10 0
7 6	82	NATIONALLY	107	2 7 6	5 15 0	2 10 0	2 12 6
8 0	104	NATURAL	130	2 7 6	6 5 0	2 12 0	3 0 0
9 0	116	NAUSEATED	145	2 7 6	6 17 6	2 15 0	3 5 0

TIMBER FRAME NOT INCLUDED



№342

IMPROVED FRICTION HOIST Code:—NEGLIGENCE

See Page 19

PRICE, including WROUGHT-IRON Driving Pulley, but exclusive of Chain ... ... £18 0s.

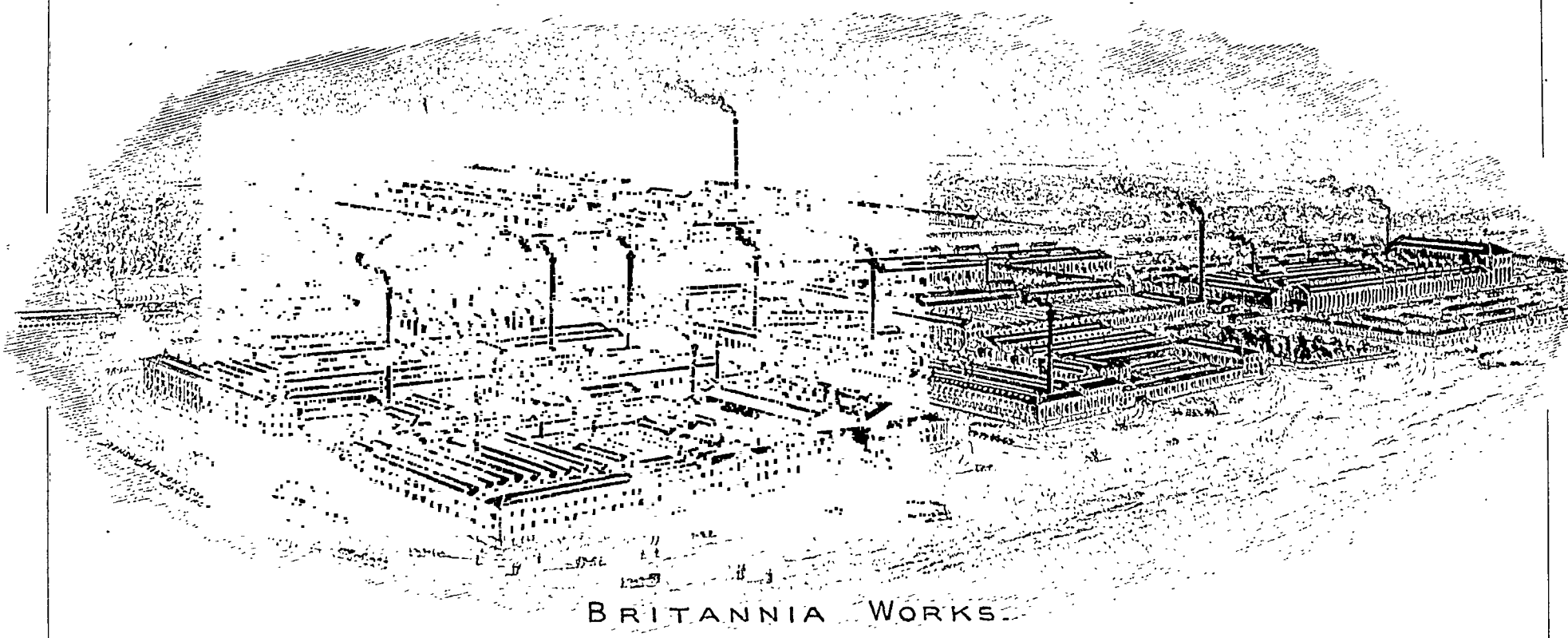
Best best short link Crane Chain $\frac{5}{16}$ in. 8d. per foot, $\frac{3}{8}$ in. 9d. per foot

Packing for Export, £1 extra

MARSHALL, SONS & CO., LIMITED

GAINSBOROUGH, LONDON, CALCUTTA, BOMBAY, and DUNEDIN, N.Z.

Area of Works, 28 acres. Employing 3,500 hands. Upwards of 75,000 Engines and Boilers made.
The GRAND PRIX and GOLD MEDAL, Paris, 1900.



BRITANNIA WORKS.

GENERAL ENGINEERS AND MANUFACTURERS of High-Class Horizontal Engines up to 1000 H.P. Vertical Engines with and without Boilers. Undertype Engines, high pressure and compound. Electric Light Engines. Portable and Semi-Portable Engines, Road Rollers and Traction Engines. Thrashing, Grinding and Sawing Machinery. Tea Preparing Machinery. Gold Dredging Machinery, &c.

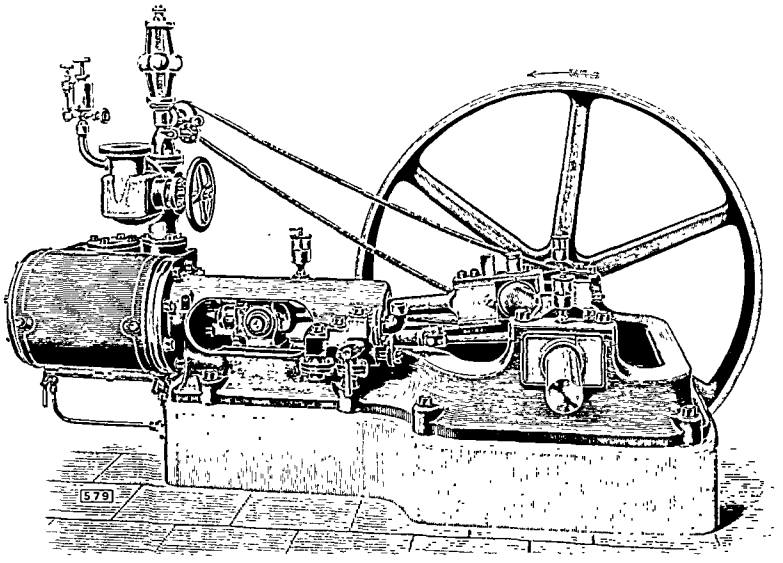
MARSHALL, SONS & CO. LTD

Britannia Iron Works

AND TRENT WORKS

GAINSBOROUGH, ENGLAND

ADDRESS FOR TELEGRAMS—"MARSHALLS, GAINSBOROUGH." NATIONAL TELEPHONE—No. 10.



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HORIZONTAL FIXED ENGINES

Owing to the largely increasing demand for our **Fixed Engines.** we have been compelled to considerably extend this branch of our business, and to add to our already extensive plant the most modern Machine Tools and appliances for turning out this class of Engines with the utmost accuracy and expedition.

To enable us to supply Engines thoroughly adapted to the various purposes for which they are required, we are now manufacturing them of several classes as described below.

The prices of our Classes M. P. & M., Engines are given on page 8 exclusive of Boilers. Particulars of the latter of the Cornish and Lancashire type are given in a separate Catalogue: we, however, supply many of our Fixed Engines with Cylindrical Multitubular Internally-fired Boilers, Locomotive Multitubular Boilers, and Underneath-fired Cylindrical Multitubular Boilers, but as the proportions and equipment of these vary to meet circumstances, localities, and description of fuel, it is difficult to embody these in a current price list, but specifications and estimates will be given on application.

Class M P or Class M.—Self-contained Engines, fitted with the Pickering Governor and Equilibrium Throttle Valve, or with the Moore Patent Crank-shaft Governor and Automatic Expansion Gear, for pressures up to 100 lbs.

(The 14½" and 16" Class M P and M Engines are strong enough for 120 lbs.)

Class K. or Class K D.—Slide Valve Engines with disc Crank, stroke twice the diameter of Cylinder, and fitted with Hartnell's Automatic Expansion Gear for Boiler pressures up to 100 lbs.

Class G. or Class H.—Long-stroke Trip Gear Engines with Proell's two-valve releasing Gear and Corliss Exhaust Valves, for Boiler pressures of 80 to 100 lbs.

Classes G. G. C. and G. H. C., G. T. and H. T.—Coupled and Tandem Compound Engines with Proell's Valve Gear, for pressures up to 140 lbs.

Classes L. and L. H.—Long-stroke Trip Gear Engines with Marshall's Patent Valve Gear, for Boiler pressures of 80 to 100 lbs.

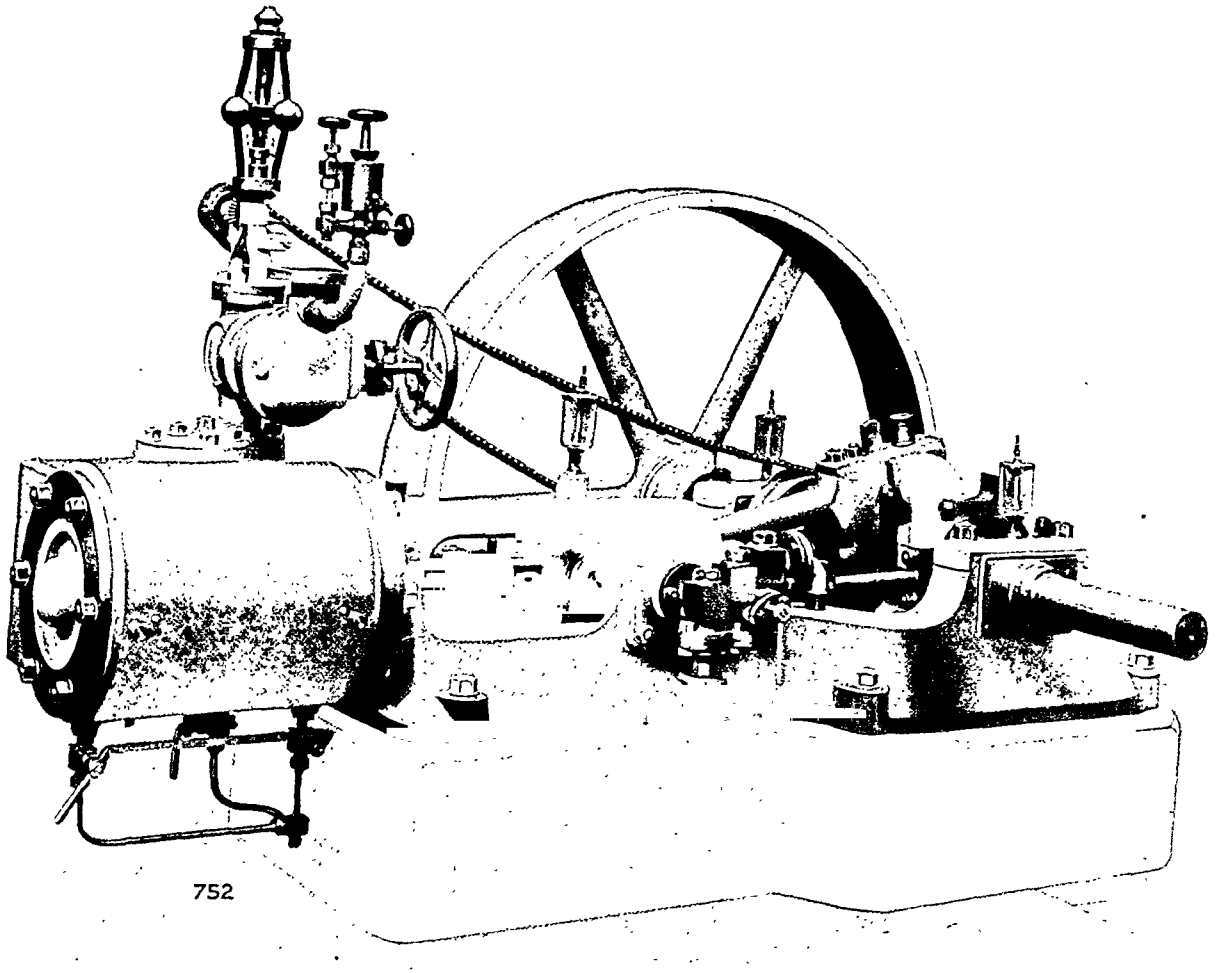
Classes L. C. and L. H. C., L. T. and L. H. T.—Coupled and Tandem Compound Engines with Marshall's Patent Valve Gear, for pressures up to 150 lbs.

For particulars of these Engines see separate Catalogue

SELF-CONTAINED

HORIZONTAL FIXED ENGINES

Class "M P" AS MADE FROM $4\frac{1}{2}$" TO 11" CYLINDER INCLUSIVE



752

Class M P fitted with **Pickering** sensitive Governor and Equilibrium Throttle Valve. This Governor is driven by a Link Leather Belt from the Crank-Shaft, and is supplied with a separate spring adjustment for varying the speed whilst the Engine is in motion, as shown above.

Class M fitted with the **Moore** Patent Crank-Shaft Governor and Automatic Cut-off Balanced Slide Valve.

These Engines are intended to supersede those described in our previous Catalogues. have been specially designed to utilize to the best advantage the higher pressures of steam now largely used in Boilers of all kinds—and for this purpose they are constructed throughout of ample strength to work with steam up to **100 lbs.** pressure if required. They are self-contained, massive in design, of the best materials and workmanship in every detail.

We recommend the **Class M P** Engines for general industrial purposes, but they are also suitable for **ELECTRIC LIGHTING** and similar work requiring great steadiness in running.

We have supplied a considerable number of these **Classes M P** and **M** Engines. which we find are giving the utmost satisfaction in every respect; we make each of the two types with Cylinders from 4½ in. to 16 in. diam., inclusive.

The **Form of Bed** is such as to ensure the maximum strength and rigidity in working—the trunk end of the bed being bored to form sliding surfaces of large area for the cross-head. and the opposite end is specially constructed to receive the journals of the crank-shaft.

The **Cylinder** is of cold-blast iron. with a separate liner forced in. and the outer casing is well felted and covered with a steel plate.

The **Piston** and **Valve Rods** are steel, and the cross-head slippers adjustable. The stop valve is a sliding valve with worm on spindle and hand wheel.

The **Crank-Shaft** is of **Steel.** bent from a single bar without welding. and of sufficient length to receive a pulley on the opposite end to the fly-wheel. thus enabling the power to be given off on either side of the Engine or both sides at once.

If two **Driving-Wheels** are required, we strongly recommend that these be both put on the same side of the engine, and the shaft extended with a neck on for the outer bearing. This can be done at a slight extra charge. A driving-wheel on each side of the Engine makes it inaccessible to the attendant for cleaning purposes.

NOTE.—The Governor in connection with the Class M Engines and the Eccentrics in Class M P Engines of 12 Ins. and upwards are placed outside the Engine Frame as shown on page 6, and the Fly-wheel is usually placed on the opposite end of the Crank-shaft; thus there is only room on the outer end of the shaft in these larger Engines for a narrow pulley.

Variable Expansion Eccentric, and Reversing Apparatus.—We apply this valuable adjunct to all our **Class M P** Engines without extra charge. By means of this Apparatus the admission of Steam can be varied from full power down to as low as one-fourth, with proportionate economy in fuel according to the power given off. Only one eccentric and slide valve are used, thus no extra wearing parts are introduced. It also forms a simple Reversing Apparatus, enabling the engine to run in either direction to suit the machinery to be driven.

The **Fly-Wheel** is of ample weight and suitable width to receive a driving belt capable of giving off the full power of the Engine, and it can be arranged to run in either direction to suit the work.

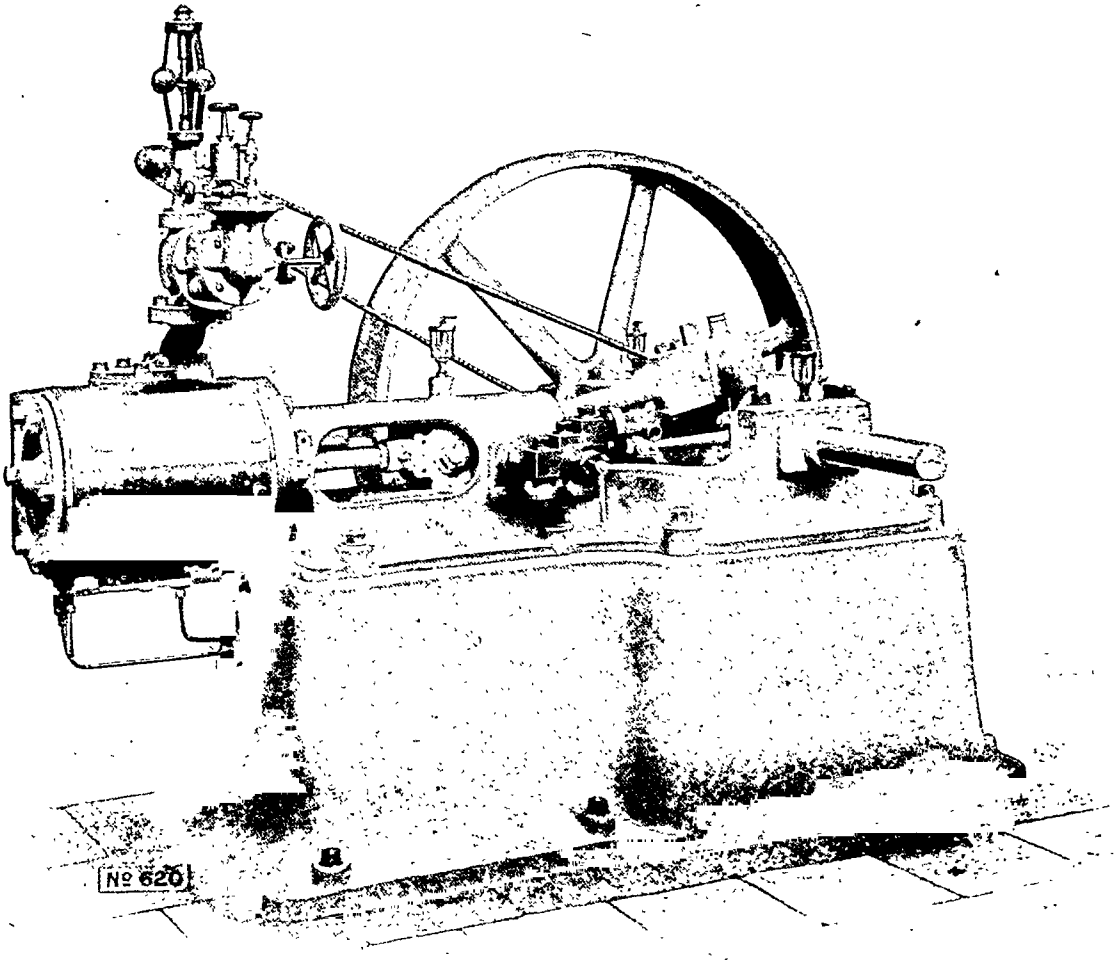
A **Force Pump,** worked by an Eccentric from the crank-shaft. and fitted with gun-metal valve boxes and valves, can be supplied when required, with all sizes of Engines except the 14½ in. and 16 in., at the extra price named on page 8.

SELF-CONTAINED

HORIZONTAL FIXED ENGINES

Class "M P"

FROM PHOTOGRAPH OF 7½" × 10" SIZE, ON DEEP CAST-IRON BASE



The **Class M P** and **Class M Engines** are specially adapted for driving **ELECTRIC LIGHT MACHINERY**, a large number being engaged on this work, with the most satisfactory results, and for this purpose the speeds can be somewhat increased, if required. Drop-sight Feed Lubricators are fitted to the crank-shaft bearings and cross-head, and these are so arranged that they may be re-filled whilst the Engine is running. **Special lubricating arrangements** for long continuous runs can also be provided at a slight extra charge.

For promoting **ECONOMY IN FUEL**, we supply in connection with these Engines, when required, efficient **Feed-Water Heaters** for heating the feed-water to a high temperature on its passage to the boiler, by means of the exhaust steam. For prices of these Heaters, see page 8.

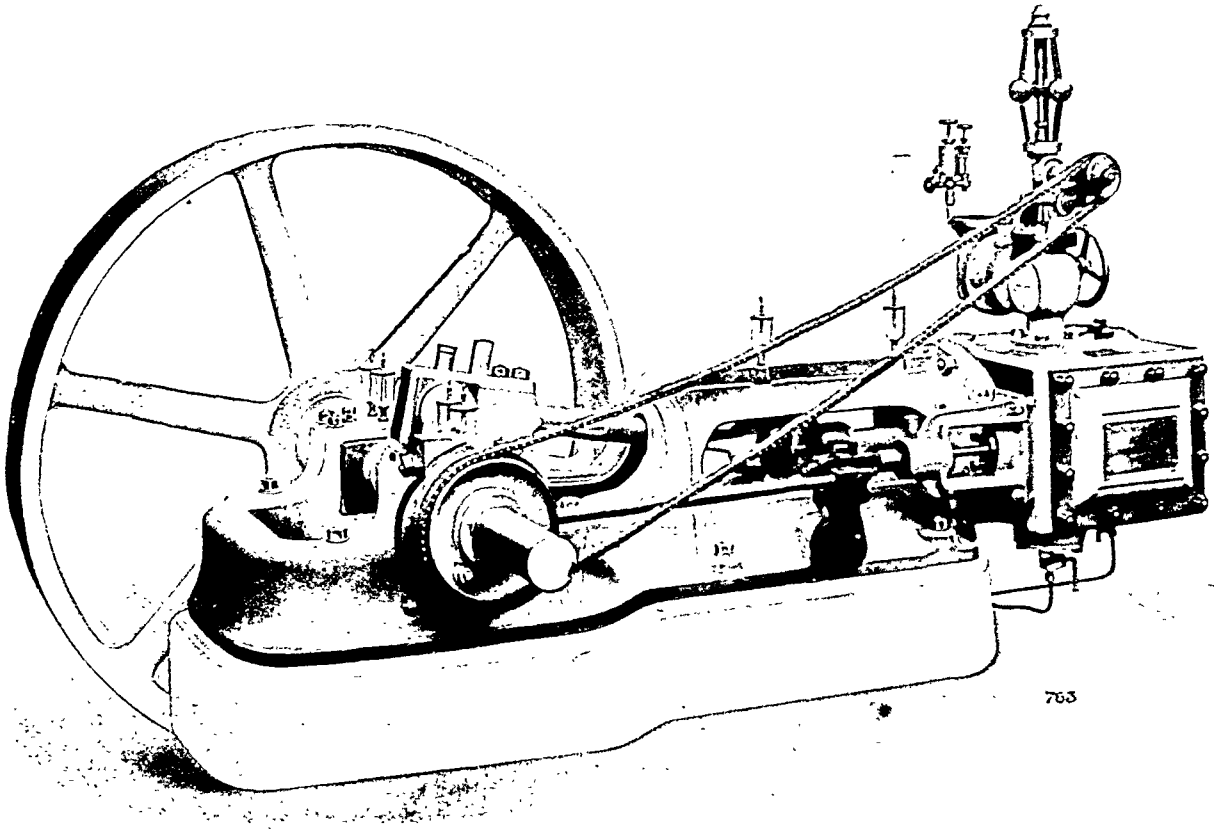
The Engines can be mounted on a **CAST-IRON FOUNDATION** as shown above of suitable height for the fly-wheel to clear the ground. Dimensions and extra cost of these bases on application.

SELF-CONTAINED

HORIZONTAL FIXED ENGINES

Class "M P"

AS MADE FROM 12″ TO 16″ CYLINDER INCLUSIVE



The above Illustration, taken from a Photograph of an Engine with Cylinder 13″ diam. × 16″ stroke, will show the design and general construction of the larger series of **Class M P Engines** as made from 12″ to 16″ diameter of cylinder inclusive.

The Engine frame is stiffer and more massive than in the smaller sizes and the eccentrics are outside the Engine frame, as shown above.

With the 14½″ and 16″ Engines—both **Class M P.** and **M**—we include Fly-wheel Barring Gear, and a third Bearing and **A** standard for the outer end of the Crank-shaft beyond the Fly-Wheel. These two sizes are of ample strength for steam pressures up to 120 lbs.

HORIZONTAL FIXED ENGINES

CLASSES "M P" AND "M"

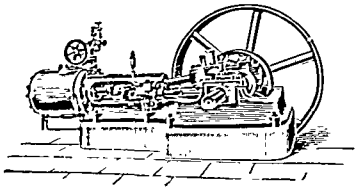
As the term "Nominal Horse Power" is apt to be misleading, we have decided not to make use of it in connection with these Engines, and they will be designated by the size of the Cylinder. As these new Engines have been specially designed to work at a High-Pressure, and at a high rate of Piston Speed, they will consequently give out considerably more power than ordinary Engines with Cylinders of the same diameter; therefore, kindly bear this in mind in comparing these Engines with those of other makers. We have given in the Table below the Effective Horse Power developed by the different sizes of Engines at 60, 80, and 100 lbs. Boiler Pressure.

Cylinder		Revs. per	Diameter of	Effective Horse Power at Boiler Pressures of					
				60 lbs.		80 lbs.		100 lbs.	
Diameter	Stroke	Minute	Fly Wheel	Economical Load	Maximum Load	Economical Load	Maximum Load	Economical Load	Maximum Load
4½"	8"	260	3' 0"	3¼	4½	4½	5½	5	6¼
5½"	8"	260	3' 0"	4½	7¼	6½	9	7½	10
6½"	10"	210	3' 6"	6¾	10	9¼	12	10½	14
7½"	10"	210	3' 6"	9	13	12¼	17	13¾	19
8"	12"	175	4' 6"	10	15	14	19	16	21
9"	12"	175	4' 6"	13	19	17½	24	20	26
10"	14"	150	5' 0"	16	24	22	30	25	33
11"	14"	150	5' 0"	19½	29	26½	36	30½	40
12"	16"	130	6' 0"	23	34	31½	43	36	48
13"	16"	130	6' 0"	27	41	36½	50	42	56
14½"	20"	105	8' 0"	35	53	49	67½	55	75
16"	20"	105	8' 0"	43	65	59½	81½	66	90

The above table gives the speeds we recommend for the Class "M" Engines, and also for the Class "M P" Engines when driving **ELECTRIC LIGHT** or other quick running Machinery, but when the Class "M P" Engines are used for general industrial purposes a somewhat slower speed is generally adopted as given below. With the smaller number of revolutions the Engines will of course not develop so high an effective Horse Power, as will be seen from the table below. The Class "M" Engines should always be run at the higher speed.

4½"	8"	190	3' 0"	2¼	3¼	3¼	4	3½	4½
5½"	8"	190	3' 0"	3¼	5¼	4½	6½	5½	7¼
6½"	10"	168	3' 6"	5¼	8	7¼	10	8½	11
7½"	10"	168	3' 6"	7¼	10	9½	13½	11	15
8"	12"	140	4' 6"	8	12	11	15	12½	16½
9"	12"	140	4' 6"	10¼	15	14	19	16	21½
10"	14"	120	5' 0"	12½	19	17½	24	20	26¼
11"	14"	120	5' 0"	15½	23	21	28½	24¼	32
12"	16"	105	6' 0"	18¼	27	25	34½	28½	38¼
13"	16"	105	6' 0"	21½	32½	29	40	33½	44½
14½"	20"	85	8' 0"	28	42¼	39	54	44	60
16"	20"	85	8' 0"	34½	52	47½	65	52½	72

For Prices see page 8



SELF-CONTAINED

HORIZONTAL FIXED ENGINES

CLASS MP :—Fitted with PICKERING Governor and Throttle Valve.
CLASS M :—Fitted with MOORE patent Crank Shaft Governor, and Automatic Cut-off Balanced Slide Valve.

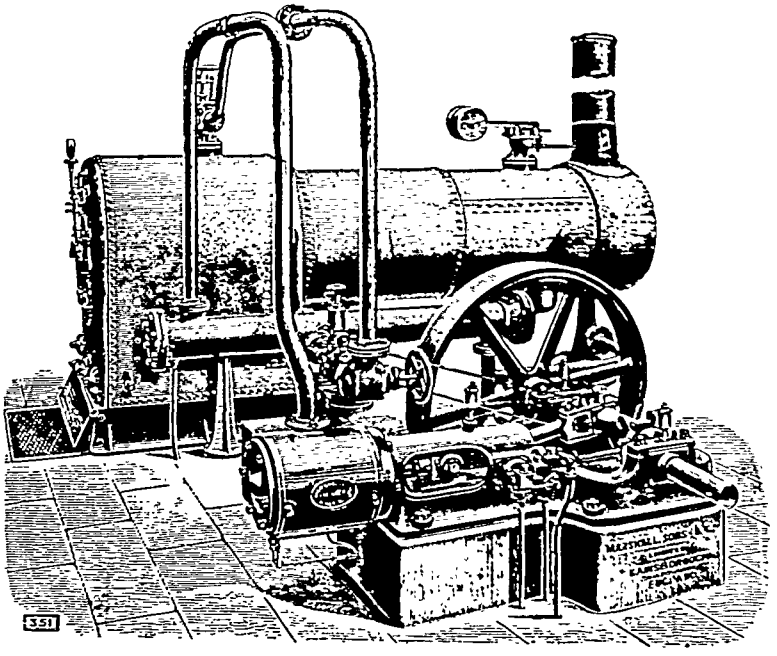
Diameter of Cylinder	Class "MP" Engine	Code Words	Class "M" Engine	Code Words	Force Pump Code:— AGRAULUS	Foundation Bolts Code:— AGRENTICOS	Deep Cast Iron Base Code:— DANDLES	Water Heater with Brass Tubes HORIZONTA Code: AGRIPPA	Water Heater with Brass Tubes VERTICAL Code: DAMOTARY	Packing For Inland Transit	Packing For Export
4½"	£31 10	DATELESSLY	£33 10	DEADLY	£3 10	£1 10	£7 0	£15	...	£0 15	£1 5
5½"	37 10	DAUBED	40 10	DEAFENED	3 10	1 10	7 0	15	...	1 0	1 15
6½"	48 0	DAUNTED	51 10	DEALBATI	4 0	2 0	8 0	15	...	1 10	2 10
7½"	58 10	DAVONTER	64 0	DEARSLEY	4 0	2 0	8 0	15	...	1 15	3 5
8"	71 0	DAUNTER	77 0	DEARTH	5 0	2 10	13 5	15	£20	2 5	4 10
9"	86 0	DAVANTERY	95 0	DEBACLER	5 0	2 10	13 5	15	20	3 0	5 10
10"	109 0	DAWLERY	120 0	DEBARQUER	6 10	3 0	18 10	20	25	3 15	6 10
11"	130 0	DAYSTAR	144 0	DEBAUCHERY	6 10	3 0	18 10	20	25	4 10	7 10
12"	152 0	DAYWORK	167 0	DEBELLATOR	8 10	4 0	23 0	...	35	5 5	8 10
13"	170 0	DAZZLIFIED	188 0	DEBENHAM	8 10	4 0	23 0	...	45	6 0	9 10
14½"	*242 0	DEADSOME	*262 0	DEBAUCH	No Pump	5 10	58 10	...	55	7 10	15 0
16"	*281 0	DEADISHLY	*306 0	DEBENTUM	No Pump	5 10	58 10	...	55	9 0	18 15

* These prices include Flywheel Barring Gear, a 3rd bearing, and A standard for the outer end of the crankshaft beyond the flywheel.
Special Lubricating arrangements for long continuous runs can be applied to these Engines at a slight extra charge.
Code Word—DEBORAH

ARRANGEMENT OF

HORIZONTAL FIXED ENGINE

WITH LOCO-MULTITUBULAR BOILER

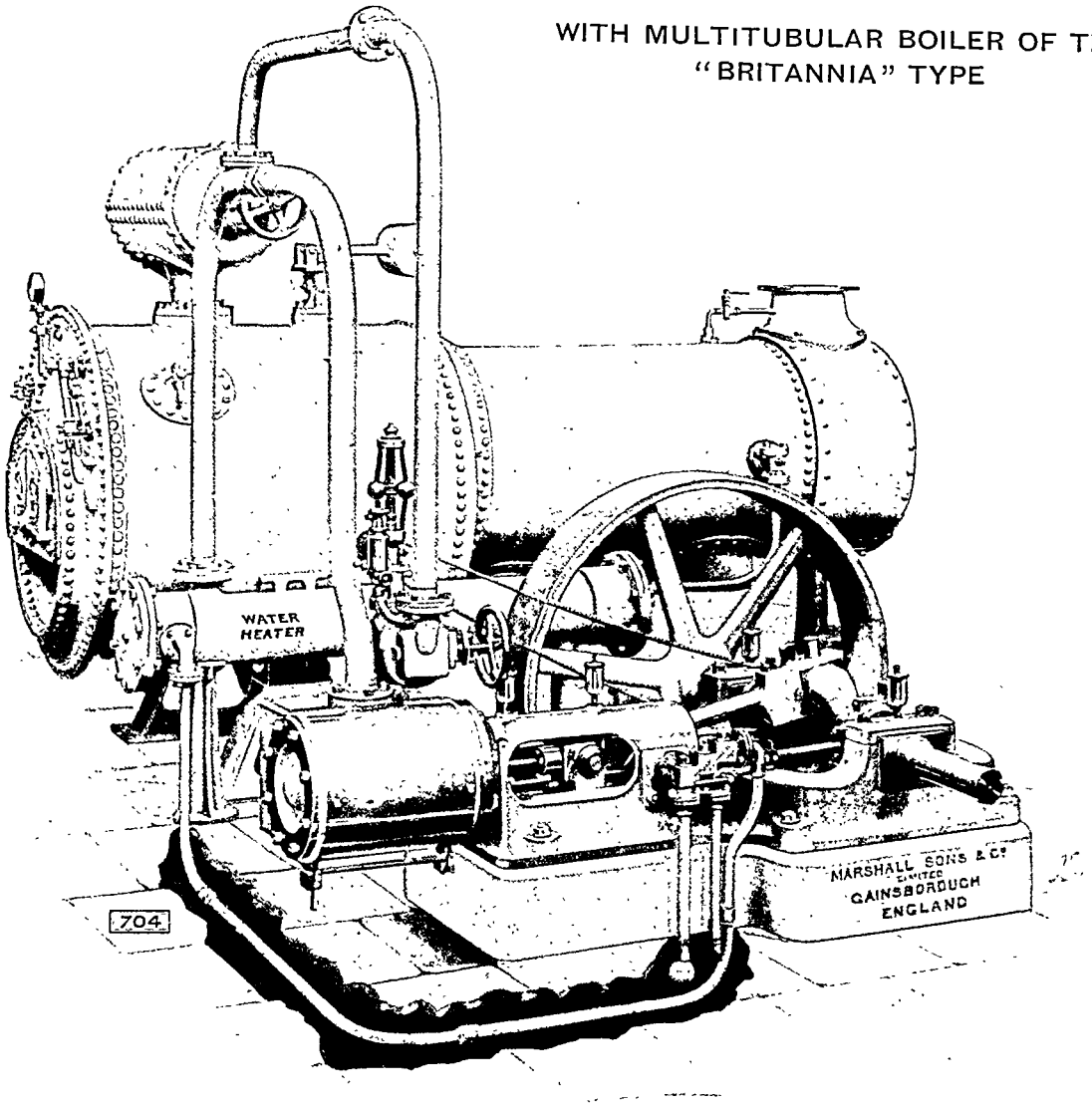


UPWARDS OF **75,000** ENGINES AND BOILERS MADE

ARRANGEMENT OF

CLASS M.P. HORIZONTAL ENGINE

WITH MULTITUBULAR BOILER OF THE "BRITANNIA" TYPE



The above Illustration represents our latest and most approved arrangement of a Self-contained Horizontal Engine, **Class M P**, with a separate Multitubular Boiler connected together and in position for work.

We manufacture Horizontal Engines of several Classes and a variety of sizes, all of which are suitable for use in connection with this class of Boiler, especially the smaller sizes. With large Fixed Engines we recommend Cornish, Lancashire, or Cylindrical Multitubular Boilers, but where it is not convenient to build the necessary brick work setting and chimney stack required for Boilers of this description, then the Locomotive or "Britannia" type Boiler can be used with advantage.

In this arrangement we recommend the adoption of a Feed Water Heater as shown above. This Heater contains a series of Brass Tubes, and heats the feed water to a high temperature before entering the Boiler, thus promoting economy in fuel as well as intercepting the entrance of grease and sediment into the Boiler.

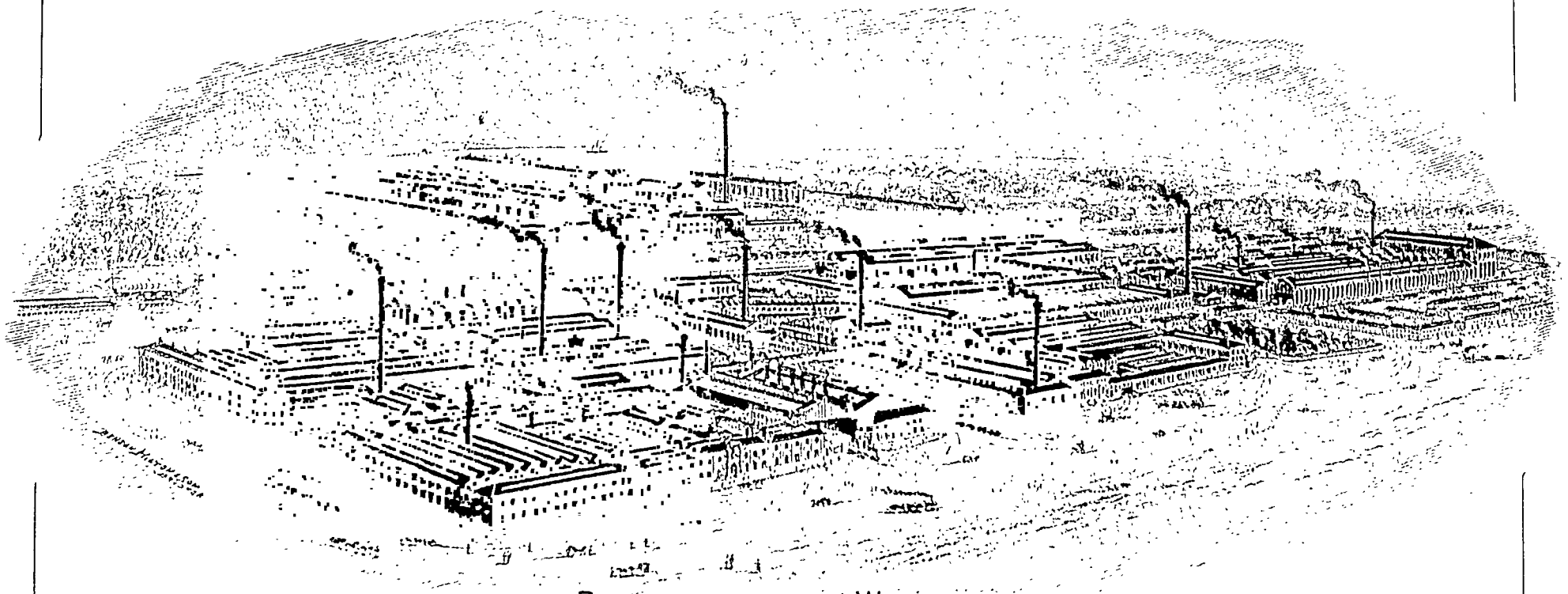
This arrangement of Horizontal Engine with Locomotive or "Britannia" Boiler is very convenient for use on Tea Estates and similar places, as the Engine can be put down inside the Factory and the Boiler under a verandah or open shed outside, so that the dust and heat from it are kept out of the building.

Prices and further Particulars on Application

MARSHALL, SONS & CO., LIMITED

GAINSBOROUGH, LONDON, CALCUTTA, BOMBAY, and DUNEDIN, N.Z.

Area of Works, 28 acres. Employing 3,500 hands. Upwards of 75,000 Engines and Boilers made.
The GRAND PRIX and GOLD MEDAL, Paris, 1900.



BRITANNIA WORKS.

GENERAL ENGINEERS AND MANUFACTURERS of High-Class Horizontal Engines up to 1000 H.P. Vertical Engines with and without Boilers. Undertype Engines, high pressure and compound. Electric Light Engines. Portable and Semi-Portable Engines, Road Rollers and Traction Engines. Thrashing, Grinding and Sawing Machinery. Gold Dredging Plants. Tea Preparing Machinery, &c.

EXPOSITION UNIVERSELLE—PARIS, 1900

We beg to announce that we have received the following **AWARDS** in the Two Classes in which we Exhibited, viz. :—

GRAND PRIX

IN CLASS 35

FOR PORTABLE, VERTICAL, HORIZONTAL AND COMPOUND ENGINES, STEAM ROAD ROLLERS, AND THRASHING MACHINES

AND

GOLD MEDAL

IN CLASS 19

FOR COUPLED COMPOUND ENGINE WITH MARSHALL'S PATENT TRIP GEAR

MARSHALL, SONS & CO. LIMITED

GAINSBOROUGH, LONDON & CALCUTTA

1629 8-00—219745